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Calf Losses Can Be Controlled ..... *American Agriculturist* 1
Good Pasture ..... *Successful Farming* 4
High Winter Egg Returns ..... *Rural New-Yorker* 6
Home Equipment Mechanizes Soil Saving ..... *Missouri Ruralist* 10
Cows, Calves and Crested Wheatgrass ..... *Western Farm Life* 12
Plant Nutrition ..... *William A. Albrecht* 15
Acre Cost of Beef ..... *Ohio Farmer* 16
Feed Tags Will Tell ..... *Kansas Farmer* 18
Butchering on the Farm ..... *Eastern States Cooperator* 21
More Plant Food Per Ton ..... *Fertilizer Review* 24
Potato Growing Trends ..... *Better Crops* 27
Landlord-Tenant Co-operation ..... *Southern Agriculturist* 33
New Roughage Harvester ..... *Capper's Farmer* 36
Guideposts for Hog Prices ..... *Hog Breeder* 39
Controlled Atmosphere Storage ..... *American Fruit Grower* 43
Drouth Resistance is Inherited ..... *Nebraska Farmer* 47
Changing Cotton Markets ..... *Nation's Agriculture* 49
The Soybean—Its Cake and Its Meal ..... *The Cattleman* 54
Winter Care of the Tractor ..... *Michigan Farmer* 61
Judging Dairy Cattle ..... *The Book "Judging Dairy Cattle"* 63
Ecology and Land Use ..... *Soil Conservation* 68
Cooperative Egg Marketing ..... *American Poultry Journal* 77
Dairy Sanitation ..... *Jersey Bulletin* 81
Proving Beef Sires ..... *California Cultivator* 84
Milk Vending Machines ..... *New England Homestead* 85
For the Farmer's Library 87

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The Farmer's Digest

Volume 4 January, 1941 Number 9

Calf Losses Can Be Controlled

Condensed from American Agriculturist

E. S. Harrison

MANY problems concerning calfhood diseases are still being debated. One group believes that improper feeding is responsible for most of our calf losses, while another equally well-informed group feels that unsatisfactory housing is the most important factor. A careful survey of calfhood diseases reveals the fact that neither of these theories provides a satisfactory answer. For example, I have visited some small herds and found the calves, though tied in dirty, unsanitary quarters and receiving no special care or feed, in thrifty growing condition. On the other hand, at some of the large breeding establishments, where the calves are housed in an up-to-date calf barn, where every detail concerning sanitation has been met and the calves fed in accordance with recommended practices, calfhood diseases are taking an extremely high toll.

What then is the answer? From my experience at Cornell and my contacts with many other herds, I am convinced that the presence of disease producing bacteria is directly responsible for all calfhood diseases. In the absence of these disease producing bacteria, calves can be raised with some degree of success even under rather unfavorable housing and feeding conditions. If the disease producing bacteria are present, however, elaborate calf barns and expert feeding will not prevent the outbreak of disease.

This does not mean that satisfactory housing and proper feeding are of no importance. If the bacteria capable of producing a specific disease are present, unsatisfactory housing and improper feeding operate to lower the calf's resistance to the disease and thus become contributing factors.

Another observation that has some significance to me is that calf losses are greater in the large herds, notwithstanding the fact that in general they are better

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equipped to handle calves than the small herds. This means that the more serious calfhood diseases increase in virulence as the period between infections is shortened. In other words, adding new calves to an infected group can be compared to adding fuel to a fire.

For years we employed, at Cornell, a rigid sanitary program and followed the best recommended feeding and management practices, but failed to control or even reduce our calf losses. Our failure to control calf disease convinced us that, if calf losses were to be prevented in the large herd, a program must be developed that would, as nearly as possible, duplicate conditions found in the small herd where calf diseases are not a problem.

Accordingly we built several small brooder-type calf barns that would hold from 8 to 10 calves. During a period of heavy freshening, one of these units is filled in less than two weeks. Once filled, no additions are made. Thus, if we are successful in getting a group of calves started free of infection, we run no risk of introducing an infection by adding new calves. On the other hand, if an infection develops, it is confined to a small group and we do not have an epidemic of disease spreading through the entire calf herd.

If an infection develops in one group of calves, the man caring for the infected unit has no contact with the other calf units. We also lock each unit which prevents hired help or visitors from traveling from one unit to another, thus guarding against carrying an infection from one unit to another.

The calves are kept in these units until about three months of age, when we transfer them as a group to a barn designed to handle older heifers. The brooder house, entirely empty, is then thoroughly cleaned and disinfected and allowed to remain idle for as long a period as possible.

Young calves may also become infected in the maternity stalls. Therefore, the maternity stall is thoroughly cleaned and disinfected after each freshening before being used again. In addition to this, it is best to provide maternity stalls whenever possible in two different barns so they will not be in continuous use. That is, follow the same program with the calving stalls as has been discussed for housing the calves.

This program of housing in no way lessens the importance of proper feeding. Calves in thrifty, growing condition have a great deal more resistance to infection, and if infected, have a better chance to live through the disease.

This program of housing has resulted in reducing our calf losses by more than 75 per cent.

The following are a few details

of construction we believe important to observe.

1. Each stall should be surrounded by a 6-inch curb.

2. The stall fronts should be solid, with the exception of the door which is built of slats to permit air circulation in the pen.

3. The side-walk should be insulated with 2 inches of insulation. The ceiling can be insulated with sawdust or shavings.

4. In cold climates the ceiling should not be more than 7½ feet high.

5. Avoid openings on the cold side of the barn.

6. The Fairbanks and Goodman ventilation system, consisting of side wall intakes and flue out-take, has proven highly satisfactory.

7. The walls of the feed room should extend to the ceiling so that this room provides a storm door entrance into the building for use in cold weather.

8. The barn should be wired heavily enough to permit the use of a small electric heater in severe weather, but no other means of heat is necessary.

9. In construction, avoid as far as possible all corners and cracks that would make the unit difficult to clean and disinfect.

10. The large door at the end of the unit should be insulated.

11. The interior of the barn should be finished in a good grade of waterproof varnish which is not only attractive and cheap, but will withstand washing and cleaning.

12. Locate the barn on a well-drained spot where there is adequate space for an outside exercise yard for each unit.

13. The roof should be quite steep so as to provide overhead storage for hay and straw.

Good Pasture

Condensed from Successful Farming

G. E. Ferris

Ohio State University

AS a general rule, a combination of liming, fertilizing, and management is what it takes to make good pasture—according to tests made on farm pastures in recent years by D. R. Dodd, pasture specialist at the Ohio Agricultural Experiment Station. Reseeding, the tests have shown, is seldom necessary. Only when there is no clover or less than five percent of desirable herbage does Dodd recommend it. He says, too, that clover in pasture cannot be maintained unless the pasture is properly managed. This includes controlled grazing to keep the herbage between one and one-half to six inches tall, and mowing if the pasture gets patchy or beyond livestock control.

The importance of clover in pastures is shown by an analysis of herbage from a pasture that had been limed, fertilized, and managed properly, as compared with one not so treated and managed. In the first place, the good pasture containing the clover yielded 300 percent more desirable herbage, and in addition the nitrogen which the clover supplied to the soil was equivalent to 600 pounds of sulphate of ammonia fertilizer. This in turn helped increase the protein content of the grass by 50 percent.

With 30 percent of clover in the phosphate plots, there was an average increase for phosphate over the no-phosphate plots of 1,525 pounds. With six-percent clover the increase was only 1,374 pounds. When the returns from phosphate for tests in 1935 and 1936 are averaged, there is shown a gain of 1,444 pounds where a high-clover content was present and only 993 pounds where a low-clover content prevailed. On the other hand, the average return for 1935 and 1936 for 50 pounds of nitrogen, applied in addition to phosphate, was 875 pounds where a high-clover content was present and 1,574 pounds where a low-clover content was present. The nitrogen was 80 percent more efficient in the absence of abundant clover.

Where a high-clover content can be maintained, phosphate alone lowers the cost per unit of production and greatly increases the returns. In the presence of abundant clover, nitrogen in addition to phosphate produces

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small returns and greatly increases the cost. However, where clover is not present, phosphate alone raises the cost per unit of production and is less effective in increasing returns. The addition of nitrogen in this case is very effective in increasing returns and does not so greatly increase the cost per unit of production.

In the tests made so far, there appears to be little justification for potash in addition to phosphate, unless nitrogen also is supplied. Under this latter condition, the potash has been a good investment.

As an average for seven years, the addition of 50 pounds of nitrogen per acre annually to either the phosphate or phosphate-potash plots has given good returns. In fact, although the largest return per dollar invested has come from phosphate alone, the highest net return has come from the plots receiving the heaviest applications of nitrogen in addition to phosphate and potash. This is of particular significance to dairymen who are in need of maximum production per acre.

Observation has shown that although the clover content is greatly affected by soil type and weather conditions, at no time during these tests was white clover seriously injured by winter conditions. In 1934, and again in 1936, it was seriously reduced and in many instances completely killed by hot, dry summers, but it came back from seed, showing up early in the following years.

Of course, there are the locations and conditions under which a good white-clover content cannot be maintained, but Dodd has observed repeatedly during his investigations that management generally has been the factor limiting the clover content on pastures that have been properly limed and fertilized. He has had the best results from protecting the herbage from both over- and under-grazing, maintaining it at a height ranging from one and one-half to five or six inches.

With insufficient grazing in the early part of the season, the grass soon crowds out the clover. With too-heavy grazing, the stand of grass is greatly reduced. If pasture goes into the hot, dry weather of July and August in this overgrazed condition, most or even all of the clover and much of the grass may be killed.

Getting High Winter Egg Returns

Condensed from The Rural New Yorker

Willard C. Thompson

THE production of high quality table eggs has come to be recognized as part of every well-organized, balanced farm program. Hens can be made to use food stuffs efficiently and to turn farm grains into a marketable product for which there is an existing, constant demand, usually at prices which are possible of profit. This Winter of 1940-41, in particular, it seems as though the farm poultry flocks of this country could well be mobilized to do their full share of "food production" for this country, to the benefit of all concerned, producers, handlers, and consumers.

The farmer who sets out to make his layers yield profits under present day economic conditions soon appreciates that he must watch four things constantly and consistently, as the Winter progresses: (1) The rate of egg yield of his flocks. Margins of profit cannot be made unless the Winter poultry flocks do yield large numbers of eggs. He must get high daily production, and yet maintain the health of the layers.

(2) The value of the poultry feed consumed by his flock. The feed bill is the largest single item entering into the cost of table egg production. The value of poultry feeding stuffs is apt to fluctuate both widely and often during this coming Winter, and the price movement must be watched carefully.

(3) The health, vigor, and activity of the hens under wintertime conditions, which are not naturally conducive to egg yield. Flock mortality, when it reaches high figures—and more than 12 per cent mortality over the whole laying year must be considered high, in my opinion—ruins the chances for fair profits in egg production.

(4) The prevailing price being paid for table eggs.

We would suggest that every poultry flock owner plan to become a mathematician this coming Winter season, at least to the extent of estimating "the cost of producing a dozen of eggs" under existing conditions. He should do this calculating whenever either of these three conditions change appreciably: (a) The cost of feed; (b) The rate of egg yield in the flocks at hand; and (c) The prices received for eggs. Now, to repeat, plan to figure the "cost of producing eggs" whenever one or more of these three

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factors are seen to be changing. Why? To find out just how one stands as to the economy of poultry flock management, as to whether or not any money is being made on that side of the farm operations, as to possible weak places in the flock management which should be changed or corrected, and as to those points which undoubtedly might be emphasized more fully—the good points.

Here is a very simple, but reasonably accurate way to get this all-important "cost of producing a dozen of eggs." Get the following information for the time at which this figure is being determined: (1) The cost of 100 pounds of the poultry ration being fed. This figure should be easily computed from the last feed bills, or from grain prices quoted in the available daily papers. Multiply this cost per cwt. by 0.25, for the average laying flock will consume laying ration (mash and grain taken together) at an average rate of about 25 lbs. of feed per day per 100 birds. This answer, then, will represent about the cost of feed consumed per day per hundred hens, under existing feed costs. (2) The rate of egg yield for the period under consideration. Find this in terms of "egg yield, in dozens, per hundred layers per day." That should be an easy figure to compute, if one knows how many hens there are in the flock and how many eggs were laid by that flock. (3) Divide $0.37 by the "egg yield, in dozens, per hundred layers per day," to get at an average cost of "overhead and labor costs" of producing one dozen eggs. This is based on what it did cost some 200 egg farmers over a 5-year period for all overhead and labor, for everything except feed—$0.37 per day per hundred layers. Let's accept that as a reasonably accurate figure, at least close enough to use for this purpose. (4) Divide the cost of feeding 100 layers for one day by the number of eggs produced by those layers in one day, that is, divide the answer in (1) just above by the answer in (2) just above. Add to this the answer in (3) just above. The result will be a close approximation of "the cost of producing one dozen eggs under present conditions."

(5) Figure out just what return is being realized from the sale of the eggs produced, on a per dozen basis. Compare this with the cost of production. The margin will be either plus or minus, either profit or loss—and it is very important to know which it is.

Insuring a Margin of Profit

To make sure that the answer to the above arithmetical problem is a plus answer, that is, profit instead of loss, the poultry flock owner this Winter must try to set up a scheme of flock managing which will bring about a suffi-

ciently high egg yield to bring the cost of producing a dozen of eggs down to a figure lower than the price received for those eggs.

So far as the feed cost is concerned, about all that can be done there is (1) To buy poultry feed wisely and advisedly; (2) To feed the ration economically and efficiently; (3) To avoid waste; (4) To induce a proper consumption of the ration being used.

For the purposes of this article at this time, it must be assumed that the farmer will have certain stock at hand. It is, therefore, not now possible for him to do much about stock improvement through selection and breeding. He may, and should, of course, plan a constructive breeding improvement program for another year. For this Winter, however, he must use the stock which is at hand. What can he do with the poultry flocks at hand to improve Winter season egg yield? Here is a practical list of suggestions: (1) Make sure that the hens are comfortable—layers surrounded by an uncomfortable Winter environment will not eat well, remain active and vigorously healthy, and economically productive. This means going over the walls of the poultry house, stopping up all cracks, and making the Winter laying house wholly tight, and draft proof. (2) Keep the layers closely confined to the houses for the duration of the Winter, where they will be more uniformly comfortable day after day and where they will be held nearer to the food hoppers. (3) Provide four square feet of floor space per hen in the laying house; over crowding layers is not conducive to maximum egg yield results. (4) Litter the floor with about six inches of straw, clean, and sanitary insulation against the coldness, the hardness, and possible dampness of the poultry house floor, which is usually a concrete floor. The hens will tend to scratch the litter toward the back of the room every day, away from the light. Occasionally take a fork and move the litter toward the front of the pen again. Change it or add to it whenever necessary to keep it in good condition. The litter is an important factor in the management of the farm poultry flock during the Winter season. The hens will drop manure in this litter during the day, of course, and so when the hen house litter is finally changed it should become a valuable fertilizer for use in the farm fields. It can be mixed with the manure which has been removed from the droppings boards. (5) Provide a six foot mash hopper, with feeding opening about four inches wide, and accessible from both sides, for every 50 hens. Keep this dry mash hopper furnished with egg-stimulating mash every lighted hour during which the hens are down off the perches.

Never let this supply run out. Go through the pens every morning, stirring up the mash, and adding a bit of fresh mash. The layers will follow through and go to work on it. It stimulates greater mash consumption, and that is a prerequisite to higher egg yields. (6) Keep the water pan always full of clean, fresh water, and never let it run dry. Layers need a large amount of water every day. (7) Gather eggs at least twice daily during wintertime, to avoid chilling or losses due to freezing. (8) Keep the nests scrupulously clean, and well bedded with some such litter as pine shavings. We like these for they shape easily and absorb moisture, keeping the nest dry, are easily handled, and are not costly, as a rule. (9) Gather eggs with clean hands, and into clean baskets. Keep the eggs clean. Nature produced them perfectly clean of shell. (10) Store the freshly gathered eggs in a clean place, free from bad odors, and where there is considerable moisture in the atmosphere, rather than in a dry air, and where the temperature is not above 65 degrees Fahrenheit. Under such conditions table eggs will not deteriorate appreciably even if held there for several days before marketing them. (11) Pack eggs in clean, whole cartons or cases; containers which are attractive in appearance, durable enough to carry the eggs safely to the consumer without breakage, and convenient enough to allow of quick handling.

Figuring Egg Production Rates

There is another arithmetic lesson for farmer-poultrymen, which is a logical part of this discussion. One often hears the question asked as to what per cent of egg yield is being turned out by such and such a laying flock, or as to what average egg yield is being shown. There are many ways in which such figuring is done, but there is only one way of which we know that this figuring should be done, in fairness to the business of egg production. The flock owner should want to be able to state the condition of his egg production business at any particular time, for his own guidance.

We suggest: (1) That all egg yield rates should be based on "egg days." This means that "a live hen in a pen for a day constitutes an egg day, that is from such a unit there is a potential of an egg." An egg a day by every live hen is 100 per cent yield, of course. Well, then, if one divides the real or actual number of eggs produced within a given time by a flock of layers by the total number of egg days, the per cent of egg yield for the flock for that time is ascertained, fairly and justly. Let's illustrate by an example. Suppose that the farm laying flock starts off on November 1 with 500 pullets in it. On November 15 four were removed

and sold, and on November 25 two more were removed. Then the egg days, or the greatest possible egg yield from that flock for November would have been: November 1, 15 x 500 hens per day, or 500 x 15, which equals 7,500 egg days; then from November 16-25 (10 days) the egg days were 496 x 10 or 4,960; and from November 26-30 (5 days) there were 494 x 5 or 2,470 egg days, making a total of 7,500 plus 4,960 plus 2,470 egg days, or possible eggs for November, if every hen had laid an egg every day. But suppose that actually 7,465 eggs were gathered. Divide 7,465 by 14,930, which gives .50, or 50 per cent production for the month. That is a fair statement, and shows one just what did happen in that flock as to egg yield during the month.

(2) Another way to express rate of yield often used is "average egg yield per hen per certain time period." Let's use that example again; there were 14,930 egg days in that flock for November. Divide that number by the number of days in November, which is 30, of course, and the average number of layers in the flock per day for November was 497.6. Then divide the actual production, which we have said was 7,465 by 497.6, and we find that the average egg yield per bird for that month was 15 eggs, approximately.

Home Equipment Mechanizes Soil Saving

Condensed from Missouri Ruralist

THE terracing program thruout the country may be speeded up as a result of a discovery that "homemade" terraces can be built with a tractor-mounted disc-plow—at less than half the cost of terraces built with heavy contract graders. The plow is a standard model "direct-connected" to the tractor, more suitable for constructing and maintaining terraces than "pull-type" models.

In many soil conservation districts, terracing has slowed to a standstill for lack of big crawler tractors and heavy graders to do the work. Farmers have paid $35 to $50 per lineal terrace mile, or $3 to $3.75 an acre, to hire con-

Reprinted by permission from the Missouri Ruralist, Nov. 9, 1940

tract outfits. But there just aren't enough contract terraces available for hire.

With hundreds of Texas farmers fretting over the delay, experiments were started in Dallas county with the small home-owned disc-plows. Not only did the regular farm tractor outfits succeed in building and maintaining terraces according to exact soil conservation service specifications—they lowered the cost by more than 50 per cent. Thus, with his regular farm equipment, the farmer is enabled to construct his own terraces at half the former cost.

Details of the new terracing method are being demonstrated to county agents and vocational agriculture instructors, who in most cases will assist the farmer in laying out contour lines with instruments.

The direct-connected tractor disc-plow is available in 2-disc and 3-disc sizes, for regular 1-row or 2-row farm tractors. Either size operates successfully on steeply inclined terrace ridges.

Debut of the disc-plow as a terracer adds one more unit of regular farm equipment to the list of standard farm machines contributing to soil conservation progress. The all-crop harvester is already playing a big role in answering an urgent need for equipment to harvest legume and grass cover crop seed—Crimson clover, lespedeza, vetch, kudzu, carpet grass, Austrian winter peas, crotalaria.

Sturdy, fast-operating tractor plows are proving highly useful in turning under tough-rooted cover crops, overcoming the handicap of 1-mule plows. The new tractor cultivators are being operated successfully on the contour at a saving of up to 10 per cent in fuel.

Leveling instruments now available for mounting on the tractor are being used for laying out contour lines. Regular farm tractors are being widely used for digging ponds and reservoirs, constructing dams and waterways.

Mechanized soil-saving is coming into the conservation picture.

Cows, Calves and Crested Wheatgrass

Condensed from The Western Farm Life

John A. Willard

NEW profits have come to the Durnin and Proctor ranch in Lewis and Clark county, Montana, since 1936 through a program of cows, calves and crested wheatgrass.

Together they have turned 800 acres of dusty, wind-gouged, barren wheat fields into pastures that give early spring grazing to 500 cows with calves and annually yield tons of hay and as high as 30,000 pounds of seed. In the fall, aftermath grazing and late grass growth again support the cows and calves for several weeks after native grass is dry and brown.

Claude Windecker, manager of the 13,000-acre Hereford cattle ranch in the foothills of the Rockies, says crested wheatgrass has raised the carrying capacity of the ranch 100 head in the four years, besides giving a sizeable income from seed sales. In addition, wind-eroded fields have been turned from dusty liabilities into soil-conserving assets.

The best evidence of the value of the grass as a money-maker, according to Windecker, is the results obtained with 121 two-year-old steers in the spring of 1939. The steers weighed 860 pounds in the fall of 1938 and the same weight April 14, 1939, when they were turned into a 170-acre field of crested wheatgrass.

The steers grazed there 80 per cent of the 6 weeks until June 1, when they were moved to regular summer range. In that period the steers gained an average of 2.4 pounds a day, or a total of about 100 pounds a head. They went to summer grass weighing 960 pounds a head.

Durnin and Proctor began growing crested wheatgrass first in an effort to find something to take the place of cash grain which they realized was a failure on the ranch. The Montana extension service suggested to the owners that they try the grass and the first seeding was made in 1933 on 9 acres of gravelly bottom land. The grass was seeded at 6 pounds to the acre with a nurse crop and was a bad failure. As the seed then cost 75 cents a pound, the trial was expensive.

The next year the seed was put in without a nurse crop on a loam that had a tendency to dry out. There was enough moisture for germination, however, and the grass withstood the drouth years of 1934 and 1935. The first seed,

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harvested in 1936, sold for 45 cents a pound and more than repaid the owners for the previous failure.

This success encouraged them and that fall 26 acres more were seeded to control a bad blow hazard. At this time 35 acres of irrigated land were seeded and the 1937 seed crop was large enough to seed 230 acres of abandoned farm land the same fall.

In the extremely favorable season of 1938 these three seedings yielded 30,000 pounds of seed and the acreage was raised to the present 800-acre size. Only a part of this seed was retained for planting. The remainder was sold at a good profit.

In 4 out of the 5 years that enough of the grass has been available for pasturing, the fields have been ready to pasture 10 days to 2 weeks before the native grass. Then, again in the fall, the rains bring out additional green feed that lasts several weeks, giving the cows extra milk to send their calves into the winter feed lot or onto the market in fine shape.

Under the ranch feeding system, the cows start calving about February 5 to 10 and in 60 days are 90 per cent calved out. The first milk is controlled by using dry feed and by the time the calves can use additional milk, the first green crested wheatgrass is available. After these 2 weeks the native grasses are green and ready to keep up the milk flow. Again in the fall the grass is put to work to provide milk for the calves just before weaning.

The chief native grasses on the ranch are blue joint or western wheat, fescue, blue grama, blue grass, blue bunch grass, sedges and June grass. These take up where the crested wheatgrass leaves off and give the ranch a 12-month carrying capacity of 38 acres an animal unit.

The cows and calves leave the crested wheatgrass pastures in the fall to go on dry native range and about January 1 onto alfalfa hay and grain for a 90-to-160-day winter feed. The hay and grain are grown under irrigation on the meadow bottoms and gravelly slopes.

Both Windecker and the owners agree that their program—cows, calves and crested wheatgrass—is ideal for this rolling country which receives about 15 inches of average annual rainfall.

The ranch's cattle program is one of grass-fattening yearlings for sale as fat beef in August or September. Occasionally yearlings are carried over to 2-year-olds to conform with feed supplies and market demand. The management has made a practice of buying only the best Montana-raised bulls and practices a rigid heifer and cow culling program.

Summarizing his results with the grass, Windecker says:

"We have had about equal results with fall and spring seeding and about an even distribution of successes and failures, depending on moisture conditions. The failures never have been 100 per cent, but in some fields it has taken 2 or 3 years to get results with sometimes a light reseeding to hasten the program.

"Irrigated and non-irrigated land have given equal results without much variation under all conditions. We are trying to introduce crested wheatgrass into thin alfalfa stands that are irrigable, and also in some pasture mixtures. We have every reason to believe it will be successful there. However, since our first failure, we have never tried to seed the grass with a nurse crop.

"There is just one large question in our minds about crested wheatgrass. What will it do when the fields become revegetated to the same point as native grass pastures? We know already that the grass gets finer and doesn't grow as tall. However, the total amount of forage doesn't seem to be affected or any of its other sterling qualities.

"Our total experience has been that crested wheatgrass has an ever-increasing place in ranch operations."

Three Butts to Door

Home owners should put three butts or hinges on every full length door to prevent warping or buckling at the middle. This adds only a few cents to the cost and is especially important on outside doors, where humidity and temperature differences cause warping.—I. W. Dickerson

—*Michigan Farmer*

Plant Nutrition Becoming Understandable Through Chemistry

Wm. A. Albrecht

Department of Soils, College of Agriculture, University of Missouri, Columbia, Mo.

ADVANCES in colloid chemistry are helping us to understand how the soil supplies the plants with the mineral nutrients, such as calcium, magnesium, potassium, and manganese, and with the non-minerals, nitrogen and phosphorus, so commonly deficient in our soils. Only the finer clay fraction, a small part of ordinary soils, is really active in providing plants with nutrients. Such clay, separated from the accompanying sand and silt, which serve mainly as mere skeleton parts of the soil, has now been put under chemical scrutiny while delivering its nutrients to the crop. It can be loaded, partially or completely with one or more of these in combinations, so that it is now being used experimentally as a plant growth medium. Analysis of the seed at the beginning of plant growth in such a controlled clay, and also of the crop, have served to reveal that clay--root contact represents roughly a chemical system of two colloids with a root-wall membrane between them. These colloids may pass some of their nutrient ions, not only from the soil to the plant, but may even pass from the plant to the soil. Seemingly clay can be so poor in its stock of such plant nutrients as nitrogen, potassium and phosphorus that a plant like the soybean may be running its woody tissue-making factory while the protein-making items like nitrogen and phosphorus are going in the reverse, from the plant to the soil.

Calcium, or lime, according to these experiments, does not move in this reverse direction. Apparently it must move into the plant if any growth is to occur. The seed supply of it is low. It must be supplied early if the plant is to escape plant disease in infancy and to make growth after the germination period is passed. The losses of nitrogen and phosphorus by the plants to the clay were prevented when the clay provided more calcium or lime. Liming the soil has long been good agricultural practice. Colloidal chemistry is supplying the scientific reasons for it.

When the clay gives up its calcium, potassium, and magnesium, for example, to the plants, it

takes hydrogen in their places. This hydrogen is not a plant nutrient. It makes the clay acid. In reality then, more soil acidity means less nutrients on the clay and less fertility for crop production. Calcium among the plant nutrients occupies most of the absorbing capacity of the clay. Liming is important because it restores this nutrient, calcium, for crop use, rather than that it drives the hydrogen, or acidity out of the soil. Less calcium, or more hydrogen, in the soil means increased chances for nutrients originally provided by the seed to go to the soil.

Plants losing these essential nutrients to the soil are at the same time growing their woody tissue that must be low in calcium and protein, both of which, for example, are essential animal nutrients also. Such experimental results suggest reasons for increasing deficiency diseases in animals as soils are giving up their nutrients to plants while no attention goes to putting them back as fertilizers.

Colloid chemistry is bringing us to appreciate our soils as it helps us to understand more fully how they have been providing the plants with nutrients.

Study Acre Cost of Beef

Condensed from The Ohio Farmer

Ray T. Kelsey

WHAT is the best way to feed corn and hay to get the most pounds of beef from each acre of the crop? was the question put to three lots of steers at the Madison County Experiment Farm when they were put on a feeding test last fall.

Two hundred interested cattle feeders gathered at the farm on the occasion of the Madison County Livestock Day and Cattle Feeders' Tour, to get the answer to this question, not in words but in performance. These three lots of 16 steers each had been started out last September 20; the first one, full-fed on corn silage that had been cut green about in the roasting ear stage; the second, the same except that the corn had been cut mature, in fact quite ripe and dry for the silo; and the third, a limited feed of corn and cob meal, the amount fed approximating the corn acreage consumed by the other two lots. Each lot was given a supplement consisting of soybean oil

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meal 3, cottonseed meal 3, and tankage 2, also hay as they would clean it up.

The results were what the cattle men were after and the final figures showed that the dry fed steers had consumed an acre less corn but between four and five acres more hay. They put on more beef per acre of corn but less per acre of corn and hay combined. They also gained slightly faster on limited feed than either of the other lots did on full feed and if there was any difference in finish they had the advantage, although the market price was practically the same for all three lots.

These results showed that if you want to get the maximum amount of beef from your acres that the most efficient way is to raise corn and run it through the silo. On the other hand if too much corn acreage and very little hay acreage does not fit into your farm management plan then dry feeding with more hay is still a very efficient way of producing beef. The cost of producing the feed is less per acre, as the hay can be produced at about half the acre cost as corn; also depletion of soil fertility, much greater when growing corn, is a point which must be taken into consideration.

In explaining the feeding tests H. W. Rogers, superintendent of the farm, and Paul Gerlaugh, Ohio Experiment Station, stated that cattle which are fed a limited ration handle the feed more efficiently than when full fed. They recommended about three-fourths full feed to get the maximum efficiency from the feed.

Feed Tags Will Tell

Condensed from Kansas Farmer

Paul Ijams

Kansas State Board of Agriculture

FEEDS represent a major investment by livestock and poultry feeders. It is impossible to determine by physical examination whether a feed is as represented, both as to nutritive value and ingredients, and some supervision over such products is necessary. The feed manufacturer has an investment in his business, and is entitled to protection against the unscrupulous who would adulterate feeds and thereby undersell the honest product.

The chemical composition of a product serves as a basis for determining its value as a feed. All organic feeds must be labeled to show a minimum guarantee for protein, fat, and nitrogen-free extract, and maximum fiber. Inorganic, or mineral feeds, must show a guaranty on the label for minimum calcium, phosphorus, and iodine, and maximum for salt. Also, for feeds containing 2 or more ingredients, the specific name of each must be stated on the label. With this information shown, the feeder is in position to determine the suitability of a feed for his purpose, and whether it is worth the price asked.

Since 1913, Kansas has had a commercial feedstuffs law and a feed inspection service. Its administration is a function of the Kansas State Board of Agriculture. This work is not peculiar to Kansas, as 47 other states have similar statutes, and the Federal government has jurisdiction over feed moving in interstate commerce under the Federal Food, Drug and Cosmetic Act. As manufacturers outside the state are not subject to the jurisdiction of Kansas, the feed inspection work is carried on in cooperation with the United States Department of Agriculture. During 1939, 22 cases involving shipments moving into Kansas apparently in violation of the federal statute were reported to federal authorities. Eight charged misbranding cottonseed products as to protein, 5 gray shorts excessive in fiber, and 9 soybean oil meal short in weight.

Definitions for feedstuffs are necessary not only to accomplish effective feed control, but are used by the trade and as a basis for establishing freight rates. In co-operation with the National Association of Feed Control Officials, definitions have been es-

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tablished for more than 100 feedstuffs, which are used throughout the United States and Canada. Included among the products for which definitions have been established are alfalfa, barley, sugar beet, buckwheat, coconut, corn, cottonseed, flax, milk, oat, peanut, rice, rye, sorghum, soybean, wheat, and by-products of the packing house, breweries and distilleries. New products are constantly being developed, and definitions must be established for them.

Among the definitions for wheat products are found gray shorts, Kansas gray shorts, brown shorts, bran, and wheat mixed feed. Gray shorts is defined as consisting of fine particles of the outer bran, the inner bran or bee-wing bran, the germ and the offal or fibrous materials obtained from the "tail of the mill, and must not contain more than 6 per cent of fiber. Because of the high quality of Kansas wheat, the Kansas miller is in position to make superior gray shorts, and this product is defined as Kansas gray shorts, and must not contain more than 5.5 per cent of fiber.

When a product is offered for sale as gray shorts and the analysis of an official sample shows that it is not gray shorts because it contains more than 6 per cent of fiber, the feed control official is in position to prevent further sale of the lot as gray shorts, and to institute prosecution if facts warrant such action. In any event, relabeling is required to show the product is actually brown shorts instead of gray shorts. In addition to the chemical analysis, the sample is subjected to microscopic analysis to determine whether its composition conforms to the definition. If another product has been added, such constitutes adulteration. It is permissible, however, for the manufacturer to add screenings to his product, provided the word "screenings" appears as part of the brand name. The purchaser is thus advised by the label that the product contains this additional ingredient.

Purchasers of feedstuffs, particularly those who buy in small lots, cannot afford to have an analysis made to determine protein, fat, and fiber content, as well as presence or absence of ingredients. By prohibiting the sale of misbranded feeds, and providing for the collection and analysis of samples of lots offered for sale, the state aims to protect the feeder and give him assurance the feeds he buys are as represented.

During the fiscal year, 1938-1939, 2,415 samples of feedstuffs were collected and analyzed. Sale was stopped on all lots which were deficient. Rice hulls, corncob, and eggshells have been found in feeds, although not declared as ingredients.

Recent work at agricultural ex-

periment stations has demonstrated that chicks must receive in the neighborhood of 290 units of vitamin G to 100 grams of ration during the first 8 weeks of life if they are to grow normally. The chief sources of this vitamin are alfalfa meal and milk by-products. One can readily see how important it is that a mixed feed labeled as containing either alfalfa leaf meal, alfalfa meal, or a milk by-product, actually has the ingredient present, and not alfalfa stem meal or starch as substitutes.

With feeds, like other commodities, there are good, high-quality brands and poor, high-fibrous mixtures on the market. The sale of a feed of low quality is not prohibited, so long as the correct chemical analysis and each ingredient is mentioned on the label. Examination of the label will reveal whether the feed contains any fillers of low feeding value.

The majority of feed manufacturers are striving through their high-quality feeds to place before the buying public a product which will give them greater gains, higher egg production and hatchability. Many have experimental farms where various rations and ingredients are tested, and the ingredients used in their mixed feeds are purchased upon specifications requiring merit. Long ago the feed manufacturing industry realized that if it were to progress, it must have the confidence of the feeder, and sponsored feed legislation to protect the buyer as well as the honest manufacturer. This supervisory service is paid for by the manufacturers through a small inspection fee. The increased use of commercial mixed feeds indicates that the feeders are not skeptical regarding the feeds they buy.

Warm Up Tractor

An occasional starting and warming up of a tractor, even when it is not being regularly used during winter months helps keep internal parts lubricated, suggests H. H. Musselman, head of agricultural engineering at M. S. C. Inside parts kept well oiled resist rust.

—*Michigan Farmer*

Butchering on the Farm

Condensed from Eastern States Cooperator

K. F. Warner

Senior Extension Meat Specialist for the United States Department of Agriculture

IN order to give their families an adequate supply of economical, palatable meat, farmers in the northeast states slaughter annually over 1,000,000 head of meat animals, according to the estimates of the United States Department of Agriculture.

Benefits and savings from dressing meat animals on the farm depend, in large part, upon the way in which the meat is handled. If some meat spoils, if full use is not made of all the parts, or if curing results in hard, oversalted, unpalatable meat, the losses may offset the possible advantages of slaughtering the animals at home.

Meat from well-fed young animals is usually more satisfactory than that from older, thinner ones. Fat young cows that have proved disappointing as breeders or milkers will provide more desirable steaks (and probably hamburger) than the cow that is to be retired from the herd because of age. Neither one will produce as acceptable meat as the beef calf or yearling that has been selected and fed for table use. If calves, pigs and lambs can be so managed and fed as to be moderately well fattened at those times of the year when their meat will be needed, they will be as much appreciated as the Thanksgiving turkey.

Dressing meat animals is comparatively easy if certain simple but necessary equipment is available and the animals are of medium weight or "family size." Four hundred to 700-pound steers or heifers, 175 to 225-pound hogs, and 60 to 90-pound lambs are the sizes usually preferred. Most of the state agricultural extension services and the United States Department of Agriculture have bulletins describing homemade slaughtering equipment and the simpler methods for dressing and preparing the carcass. In many communities a local butcher is available who will dress meat animals for a nominal charge. In such cases it is usually possible and highly desirable to have a veterinarian inspect them for freedom from disease and parasites.

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Proper temperature control is the most important single factor in the handling and storage of meat. Proper temperature control means the prompt chilling (within 24 hours) of the freshly slaughtered carcass to a temperature just above freezing and the holding of the curing meat at a temperature around 36° to 38° F. throughout the curing period. Under such conditions the growth of spoilage bacteria is practically stopped and the development of a uniform and desirable flavor and saltiness is encouraged.

Beef and lamb that can be held at a temperature between 33° and 40° for a week or 10 days after slaughtering will improve in tenderness due to a ripening of the meat fibers. This is the procedure followed by most commercial meat handlers. If the beef or lamb is to be preserved by freezing it is desirable to ripen it for about a week at the temperatures indicated before cutting the carcass and freezing the cuts. People used to chink up the spaces between the frozen cuts with snow so as to keep out the air. It is for this same reason that meat stored in the freezer lockers is so carefully wrapped with moisture-proof paper. Where meat is stored in commercial freezers, temperatures at zero or slightly lower appear to give the best results, especially when the meat is to be held for six months or a year. Wide variations in temperature are considered undesirable for chilled, curing or frozen meat.

Salt is used to cure meat, sugar to improve the flavor and saltpeter to set the red color in the lean. Pork, beef and lamb can be cured with salt alone but most people prefer the so-called sugar cure or mixture of salt, sugar and saltpeter. Perhaps in the Northeast an exception to that statement would be a definite leaning toward a straight salt brine for curing fat backs or "salt pork."

Salt, or the sugar cure, can be applied by either the dry or the brine method. The 8-2-2 curing mixture (8 pounds of salt, 2 pounds of sugar and 2 ounces of saltpeter) can be rubbed on to 100 pounds of cut, trimmed hams and shoulders or it can be dissolved in about five gallons of cold water and poured over the chilled meat after it has been carefully fitted or packed in a clean barrel or crock. The dry cure is faster and a bit harsher, the brine cure slower and usually milder. Where the temperature of the curing meat drops below freezing, as it often will under farm conditions, an extra day of curing time should be added for each day that the meat is colder than freezing. Some believe that the brine packs are less subject to temperature changes than the dry-cured meat.

Where artificial cold storage is available in the village to chill the fresh carcasses and keep the meat

at the proper temperature, animals can be dressed before haying or apple picking or any other time when there will be a need for an extra supply of good but economical fresh meat. In the South, where "summer" temperatures prevail even in the winter, millions of pounds of farm dressed pork are cured in artificially-chilled community meat curing plants.

Lamb meat can be cured successfully and is most appetizing. However, cured lamb dries badly after smoking and the thin ribs and loins should be used within a few days. The cured legs can be held a month or so without excessive hardening.

Corned and dried beef, ham, bacon, smoked shoulders, fresh and smoked sausage, head cheese, lard, lamb chops, boneless lamb shoulder, fresh or cured lamb leg —all are examples of delicious foods that can be made on the farm, oftentimes from animals, feeds and labor that might not have been so well used. More generous, better-balanced meals are frequently possible when home butchering is practiced.

New-Type Rat Trap

Dry, untreated wheat is serving as an effective rat trap for Ed Bowen, Taylor county, Iowa, farmer.

Bowen puts 3 inches of dry wheat in the bottom of a regular farm water tank, and places a board outside the tank so that the rats can climb to the edge and jump in.

Already more than 400 rats have been victims, for once they are inside the tank the grain slips beneath their feet so that they can't jump out. The first night he killed 55 rats with a club, and a normal night's watch catch is now 12 to 15.

When the rats "get wise" and fail to visit the tank, Bowen puts a board inside it so that they can climb in and out for a day or so. Then he takes the inner board away and gets results again.

—*Capper's Farmer*

More Plant Food Per Ton

Condensed from The Fertilizer Review

AMERICAN farmers are constantly making adjustments in their farming practices, changing their activities as new conditions arise or as new techniques develop. Some times the change involves a decline in the production of one crop and the increased production of another. More often the changes are in production methods or practices. The mechanization of agriculture is an example of this type of change.

Fertilizer practices have also changed. New and improved methods of application have been adopted, largely as the result of innumerable experiments carried on at State agricultural experiment stations. Fertilizers have been improved, both as to mechanical condition and as to their suitability for various crops and soils.

Two other important changes which have occurred in fertilizer use have been the trend towards higher analysis and a decline in the number of grades used. These changes were clearly indicated in a comprehensive survey of plant-food consumption in 1939, made by The National Fertilizer Association. The results of the survey have been published recently in a report which was prepared in co-operation with the United States Department of Agriculture.

An educational program carried on jointly by the commercial fertilizer industry and Federal and State agricultural workers, designed to acquaint farmers with the advantages of using higher-analysis fertilizers, has resulted in a substantial increase in the average plant-food content of commercial fertilizers. This makes for economy in fertilizer use, as buying of higher-analysis mixtures results in savings in freight and bagging and handling charges. Farmers in increasing numbers are taking advantage of these savings.

TABLE 1
Leading Grades of Mixed Fertilizers Consumed in the United States

Grade	Rank 1939	1934	1925
3-8-5	1	3	7
2-12-6	2	4	28
4-8-4	3	2	2
3-8-3	4	1	1
6-8-4	5	168	..
4-8-6	6	19	33
5-7-5	7	8	16
3-8-6	8	27	38
4-8-8	9	26	52
6-6-5	10	11	..

Plant-Food Ratio Increasing

In 1880 the average ton of complete mixed fertilizer used in the United States contained 13.4

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per cent of plant food. The ratio got up to 13.9 per cent in 1890, to 14.1 per cent in 1900, and 14.9 per cent in 1910. By 1920 it was down to 13.9 per cent, reflecting the shortage of certain materials during the war period.

Subsequent to 1920 there was a steady upward trend in the plant-food ratio, rising to a new peak of 19.3 per cent in 1939. The average ton of complete fertilizer used last year contained as much plant food as 2,133 pounds contained in 1934. In 1928 it would have taken 2,271 pounds to furnish as much plant food as one ton furnished last year. In 1925 it would have taken 2,413 pounds and in 1920, 2,777 pounds.

Low-analysis fertilizers containing less than 14 per cent of plant food have almost disappeared. In 1917 such analyses accounted for 88.77 per cent of all mixed fertilizers. The ratio was down to 3.94 per cent in 1934 and 2.09 per cent in 1939. As the result of recent legislation in South Carolina, providing for a minimum of 16 per cent plant food in all fertilizers sold in the State, the tonnage of fertilizers containing less than 14 per cent in 1940 and subsequent years will be negligible.

There has been a substantial increase in the use of fertilizer mixtures containing 20 or more units of plant food. (A unit is 1 per cent, or 20 pounds.) In 1917 such analyses accounted for only 2.17 per cent of the total tonnage. By 1934 the proportion was 23.93 per cent and last year it was up to 35.86 per cent. It seems highly probable that this ratio will continue to show a strong upward trend.

Shifts in the relative importance of the leading grades of mixed fertilizers are shown in Table 1. Only 5 of the first 10 grades in 1939 were among the leading 10 in 1934 and only 3 of them were among the leaders in 1925. In general, the shifts among the leaders have resulted from the trend towards the use of higher analyses. The leading grade in 1934 was 3-8-3, accounting for 13.99 per cent of all mixed goods. In 1939 it was down to fourth place, representing only 7.42 per cent of total sales. The 2-12-6 grade has greatly increased in importance and is likely to be in first place in the next year or two.

The greatest progress in the use of high-analysis mixtures has taken place in New England. Maine leads all the other States in the average plant-food content of mixed fertilizers consumed, with an average plant-food ratio of 29.76 per cent. Such high-analysis mixtures as 8-16-20, 8-16-14, 8-16-16, and 6-10-14 are widely used in the State. Analyses containing 24 or more units of plant food account for 55.77 per cent of all fertilizer mixtures sold

in Maine, compared with only 9.40 per cent in the entire country.

The lowest-analysis fertilizers, on the average, are used in the Southern States. The lowest ratio is in South Carolina, with the mixed fertilizers used there last year containing an average of 16.03 per cent of plant food. This will be somewhat higher in the future because of the legislation previously referred to.

Of the three major plant foods contained in complete fertilizer mixtures, the greatest increase has taken place in potash. The nitrogen content has also increased in recent years, but there has been no marked change in the phosphoric acid content.

If all of the mixed fertilizers used in 1934 had been combined and remixed, and the plant-food units expressed in decimals instead of the whole numbers usually used in stating fertilizer grades, the formula would have been 3.52-8.73-5.12. Last year it would have been 3.76-9.08-5.78. These figures are based on all fertilizer mixtures, including P-K and N-K mixtures.

Higher Analysis Superphosphate

There has been a very decided trend toward the use of higher-analysis grades of superphosphate as well as of mixed goods. Fourteen per cent and lower grades of superphosphate, which prior to the World War constituted the bulk of the tonnage, are now definitely obsolete. Sixteen per cent goods, which almost had a monopoly during the 1920's, are decreasing in importance very rapidly at present, while 20 per cent superphosphate has become the most popular grade. Concentrated superphosphate is also rapidly increasing in importance.

It has long been recognized by the producers of chemical plant food in the United States that an unnecessary multiplicity of grades is undesirable from various standpoints. Our knowledge of soils and of the food needs of growing plants has greatly increased in recent years, and as a result of such knowledge we now know that many of the grades which became popular years ago are not needed. Results achieved in reducing the number of grades sold in several Southern States show what can be accomplished by co-operative action on the part of the fertilizer producers and State officials.

Such a reduction tends to result in lower manufacturing and distributing costs, an achievement to be desired by producer and farmer alike since they both benefit by it. With a smaller number of grades offered for sale it becomes easier for the consumer to select the fertilizer best suited to his needs. In carrying out a program of grade reduction care is taken that grades will be available for the various soils and crops.

Potato Growing Trends

Condensed from Better Crops With Plant Food

Ford S. Prince

Agronomist, Agricultural Experiment Station, Durham, New Hampshire

FOR the third time in 11 years, J. R. Jackson and Son, Colebrook, New Hampshire, have topped the list in the New Hampshire 300-bushel Potato Club, leading a field of 28 growers in 1939 with a yield of 520 bushels per acre. They also hold the club's State record of 532 bushels per acre, made in 1934.

Other men have made enviable records in this potato "Hall of Fame," but the Jackson story is somewhat more consistent. In the first place this firm has never failed to make the club when they have entered. Second, they have a continuous club membership since 1929 when they first entered the "contest," which means that they have made this club 11 times in a row.

Space will not permit mentioning the names of all these good growers whose names will go down in New Hampshire farming history. What we are mainly interested in here is to enumerate the facts gleaned from the club members through the years.

The club was started by the New Hampshire Extension Service as an honor club for men who produced good yields of potatoes, as well as to permit county agents and extension specialists to follow the methods our growers practiced in producing these yields.

At digging time a record of the significant features of each grower's methods is taken, after which the records are summarized and sent out to the members, so that each one will be informed as to how his methods have differed from those of other growers.

Distribution of the summary sheets is not limited to those who make the club, but may be secured by anyone who is interested in the potato crop. By having these records, the Extension Service is in possession of the facts as to how growers' practices change year by year with respect to any of the important processes of potato growing.

The average yield produced by the members that made the club in 1939 was 377 bushels per acre. Two yields ran above 500 bushels, eight were between 400 and

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500 bushels, while the remaining eighteen were between 300 and 400 bushels per acre. Yields are checked by digging rows at random on a 3-acre tract. While a grower is permitted to select his best 3-acre piece for checking, this is not always done, for the simple reason that he cannot always be certain where his potatoes are going to yield the best until after his potatoes are harvested.

What do these records show as to the consummation of good potato practices, and what changes are methods undergoing? First, and probably the most significant trend, the strictly commercial grower has enlarged his acreage so that he can use power machinery and more particularly so that he can practice a shorter rotation. The old rotation consisted of 1 year in potatoes followed by 6 or 8 years in hay. This rotation often led to disastrous attacks of wire worms, due to the long period in sod crop. Now it is almost common practice to keep the land in potatoes 2 or 3 years, then follow with a green manure crop or seed to oats and clover, which in turn will occupy the land not more than 2 years.

Varieties other than the Green Mountain are creeping into our 300-bushel story. Formerly nothing but Mountains were entered, but in 1939, three men grew Chippewas, one Katahdins, while one other had both Chippewas and Mountains. While this does show a slight trend away from Green Mountain at the moment, how far it will go is as yet unpredictable.

The Green Mountain variety is pretty well established because of its yielding ability and high cooking quality, and other varieties will have to measure up to or above these high standards to supplant it. Such a variety is not yet in sight.

The amount of seed used on each acre has increased from 16 to nearly 20 bushels per acre. There is a tendency for certified seed growers to use more than 20 bushels per acre, since they plant closer in an attempt to get a more desirable size in their seed stock.

When checking the fields in 1939 for the first time, we kept a fairly careful record of the stand of potatoes our growers had secured. Due to one cause or another, we found a great many skips in most fields and discovered that although growers usually set their planters so that they will have one hill to each 11 inches of row or less, that actually at digging time there was only one hill to each 15 inches of row. In other words, on the average, hills at digging were 4 inches farther apart than they should have been had each seed piece germinated and grown.

It is quite obvious that some soils might support closer stands

of potatoes than others, and that what might be a good stand on one soil type might be too heavy a stand for another, even if the plants were evenly spaced in the row.

The fact remains that stands where the plants average 18 inches apart are too thin for almost any soil in our New England climate, and as several of these good growers had such stands, we feel that this is one of the limiting factors to potato yields, and that something should be done to remedy it. An analysis of the situation indicates that picker planters coupled with faulty seed cutting may be the cause of part of the trouble. Often mechanical seed cutters are used, and unless the knives of this machine are properly adjusted, too many slivers of potatoes, many without eyes, are produced. Since the picker planter cannot be held responsible for dropping a seed piece without eyes, this trouble must be eliminated before the seed potatoes go into the hopper of the planter.

Often a grower can adjust the knives of his mechanical cutter to do a better job. Failing in this, he can resort to hand cutting, a method which many men feel is the only way to prepare seed potatoes for planting. Adjusting the planter, especially the picker type, for closer spacing is also a method that can be used to get more satisfactory stands.

The importance of stand as influencing yields is shown by our records in 1939. Growers whose plants averaged 15 inches or less in the row had yields of 413 bushels per acre, while those whose potatoes were spaced more than 15 inches secured but 347 bushels. Stand thus appears to be a rather vital factor both to yields and profits, since with a good stand, fertilizer, spray material, and labor involved in cultural operations are not wasted.

Two trends are evident with respect to fertilizers, the use of more plant food per acre year by year and the drift toward higher analysis materials. There has been a steady increase in the amounts of plant food applied by club members. In 1939 the average application was 2,357 pounds of 20-unit equivalent, with a maximum of 2,900 pounds per acre. There seems to be a firm determination on the part of our potato men not to allow their plants to suffer for want of plant food. As operations on potato farms have expanded, manure has become less and less important as a source of fertility for potatoes. Only 5 men out of 28 report having used manure directly for potatoes. Three of these did not limit their fertilizer because of its use, one man cut his fertilizer to about three-quarters of a normal application, and one grower applied no fertilizer at all. This latter grower uses 20 tons

of manure to the acre over all his crop land each year, regardless of the crop grown.

A few years ago we reported that club members were about evenly divided in the matter of high and low analysis fertilizers. In 1939, 18 growers used nothing but high analysis goods, 5 used low analyzing mixtures, and 3 applied medium analysis materials (25-35 units), while one grower divided his application between 20 and 40-unit goods. The initial savings in buying high strength materials and the savings in cartage and labor of application have a distinct appeal.

Recent agreements in the fertilizer trade to manufacture more grades running in the medium analysis group may have a tendency to check the stampede into materials approximating 40 units of plant food. But as anyone can readily see, the trend is definitely away from the 20-unit materials which formerly ranked as favorites with potato growers.

A 300-bushel crop, leaves and tops, takes more nitrogen and somewhat more potash than is furnished by a ton of 5-8-7 fertilizer, a formula that still leads all others in quantity sold in this important potato-growing area. Although a ton of 5-8-7 carries more phosphoric acid than is used by such a crop of potatoes, the fact that an unknown but very large percentage of applied phosphoric acid is fixed and not recovered at least in the immediate growing crop, makes it always wise to apply an excess of this growth-promoting substance.

These potato growers who depend upon chemical rather than farm-produced fertilizers are not satisfied with the prospect of producing 300 bushels of potatoes per acre, but always have the hope of some higher yield in mind. Many of these hopes come to fruition in the autumn at harvest time. Since the aim is always high and since they do not wish the lack of plant food to limit their yields, they use more than a ton of fertilizer, and as our average figures now show have arrived close to the 2,400-pound mark, measured in 20-unit plant food.

Meetings of potato growers recently held in many New Hampshire counties decided upon this 2,400-pound application as a maximum recommendation, although many of the growers present indicated they would probably exceed this figure in 1940 as they did in 1939, especially in the higher analyses. These growers recognized the fact, of course, that a dairyman might cut this amount to some extent in view of the manure he applies, and they voiced the opinion, too, that if a farmer's financial condition did not permit his taking risks, it might be better for him to hold his application around the ton mark for single or the half-ton

mark for double strength goods.

This means then that the range of our recommendations for 1940 was about as follows:

Formulas	Amounts (lb. per Acre)
5-8-7, 4-8-10, and similar formulas	2,000–2,400
5-10-10 and similar formulas	1,600–2,000
8-16-16 and simliar formulas	1,000-1,200

There is no small amount of interest amongst our growers in the ratio of elements to be applied. Most of them have followed the experimental work we have done, which indicates that high phosphorus and potash in relation to nitrogen often increases yields, and there is a growing interest in this idea as well as an interest in the materials that actually are used to compound the fertilizer. Because of this interest, sulphate of potash, bone meal, organics, and other materials are coming under the scrutiny of these potato growers in actual field tests.

A slight tendency toward dusting for insect and disease protection was noted in 1939. This is probably due to advances made in power dusters that can be mounted directly on the tractor and operated with a power takeoff, thus eliminating the necessity of having two implements run over the vines. Vine lifters can easily be attached to the tractor to avoid injury, and these aids are appearing in many fields.

Some of the insect and disease problems seem to be pretty well solved, others are still aggravating. Late blight is easily controlled with liquid bordeaux or copper lime dust, except in rain-soaked and sodden fields, such as existed at the time of the 1938 hurricane. Colorado potato beetles are quickly killed with arsenicals. But the two small insects, flea beetles and leaf hoppers, still do a tremendous lot of damage in practically all fields and are the worst enemies of the potato grower at the moment. Although bordeaux has some repellent and toxic effect against hoppers, and flea beetles do not fare so well when vines are covered with arsenic, even our most careful and efficient spray operators are experiencing a great deal of commercial damage from these two minute but multitudinous pests.

There is hope on the horizon, however, since tests conducted during 1939 in New Hampshire in a limited way have clearly proved that one of the old insecticides combined with a new carrier is completely effective against flea beetles and apparently gives fairly good control of the leaf hopper situation. One grower reports that a single application of this new material kept the sprayed portion of his field in a

green and growing condition one month longer than the unsprayed portion, and increased his yield then by more than 100 bushels per acre. When the proponents of this material finally perfect it and get it out to farmers for use in their fields, potato yields will undoubtedly increase. When this time comes, we will probably be reporting 600-bushel yields as glibly as we speak of those in the 500-bushel class today.

Always provided, of course, that some new disturbing factor doesn't appear on the horizon, and one seems to be on the way. Erosion. Shortening the potato rotation appears to reduce organic matter and absorbing properties of the soil for water. Changes in the rotation which involve keeping land in potatoes a greater proportion of the time render the soil more vulnerable to washing. Two of our 300-bushel club growers are already practicing erosion control methods by means of terraces and cropping in strips on the contour, and other men may have to follow their example. Most of the potatoes in New England are grown on heavy, sloping, hill land, land that is susceptible to erosion if exposed. If our farmers realize the dangers from this source before the value of their soils is too seriously reduced, it will be a credit to their foresightedness.

Landlord-Tenant Co-operation

Condensed from Southern Agriculturist

J. E. Stanford

NEARLY half of all farmers in the United States are tenants or sharecroppers. This fact within itself is not necessarily alarming and does not constitute a blanket condemnation of farm tenancy as such. But the fact that a million tenant families (5 million farm people) move every year, and that another million families who rent farms for a year at a time approach the end of each year without reasonable assurance that they can or will remain on the same farm, gives cause for serious alarm. It stands out as one of the major agricultural and economic problems of the nation.

The big majority of these moves do not benefit either tenant or landlord. The frequent moving of tenants and sharecroppers and uncertain and indefinite tenure arrangements have seriously interfered with the effectiveness of the various farm programs for the aid and advancement of agriculture. It is difficult, if not impossible, to rehabilitate farmers who are forever on the move or to conserve the farms on which they live.

The tenure system can be improved in numerous ways without greatly changing the system and without disturbing the good relationships which prevail between many tenants and their landlords.

The first step that should be taken by a tenant and his landlord in working out satisfactory arrangements and relationships between them is to put their agreement in writing. At least three-fourths of all tenants and sharecroppers in the United States have only verbal contracts with their landlords. This is an important step in the right direction, because lack of written tenure agreements is a major cause of many misunderstandings between tenants and landlords, and results in the frequent moving of tenant families.

Important changes have brought new problems and conditions which are important and confusing to both landlords and tenants. The necessity for soil conservation and soil improvement on most farms, the need for crop rotation over a period of several years, and the importance of introducing livestock or adding to livestock on tenant farms make it all the more important that tenants remain upon the same

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farm for a period of years and that landlords and tenants put their agreements in writing in the form of a written lease. It is not the solution to all the tenure problems, but in most cases it is the first step.

It is well to remember, however, that there are bad leases as well as good ones. Better not any at all than to have the wrong kind in operation. The lease should be drawn up in plain, clear language. Each contracting party should sign it and should keep a copy for future reference. It is tremendously important that everyone concerned should fully understand all the details of the lease.

Landlord-tenant leases should outline as clearly and unmistakably as possible all important details in regard to operations of the farm, contributions of each party and rates of rent. Its terms should give the tenant a fair chance to make a good living on the farm, and should set forth definite provisions regarding the maintenance, repair and improvement of the farm. The written lease should contain an agreement by the parties that they will arbitrate any differences or disputes that may arise during the life of the contract.

The most satisfactory and widely used form is known as the Flexible Farm Lease. This form contains the important provisions which most good landlords and good tenants seem to desire in a lease, but details and special arrangements must be inserted by landlords and tenants in each case. Blank spaces are provided for that purpose, and at the end of the lease there is a blank section which may be used in adding special agreements not covered in the lease.

Among the important provisions that a desirable lease should contain are the following: (1) Detailed, clear descriptions of the property to be leased. (2) Terms of lease. This, in many cases, should be for a period of several years. (3) Rental rates and arrangements should be specifically outlined. (4) Farm operations should be described so as to show unmistakably who is to furnish workstock, machinery, seed, fertilizer, feed, etc., as well as the proportion or amount of each. (5) Maintenance, repairs and improvements should be agreed upon and so indicated in the lease. Houses and outhouses to be occupied by tenant should be described in the lease. (6) Government agricultural programs involved in the farming programs should be plainly outlined.

In the blank space should be inserted details of any other agreements that careful consideration may be determined for the particular farm covered by the lease.

The Flexible Livestock Share

Lease is available for the use of livestock farms, and is particularly applicable where the landlord and tenant or sharecropper are engaged in the production of livestock or livestock products on a share basis as the major farm enterprise.

In many cases landlords and tenants will want to outline each year the detailed plans under which the farm will be operated, and for this purpose the Annual Supplement Lease form is provided for use each year by landlords and tenants who use the Flexible Farm Lease or Flexible Livestock Share Lease. This form enables them to outline the details of farm operations each year without repeating the entire process or preparing and signing a new lease.

Copies of the above mentioned leases and other forms and related material published by the United States Department of Agriculture for aiding landlords and tenants in their leasing arrangements may be obtained from your county agent, the State Extension Service, the State College of Agriculture or from the United States Department of Agriculture, Washington, D. C.

New Roughage Harvester

Condensed from Capper's Farmer

M. N. Beeler

MAXIMUM use of roughage offered the primary hope for long range beef-making profit, Herman Dinklage decided. But whereas forage was the cheapest cattle feed to grow and least exhaustive of fertility, it was at the same time most expensive and laborious to harvest. What he needed was a machine which would handle grasses and legumes, and other green or cured forages with the same facility that a combine or mechanical husker will handle small grains or corn.

"I can buy fattening grains if I don't raise them," he explained. "They are highly concentrated and can be hauled a hundred miles if need be. And I can buy them just about as cheaply as I can grow them. But that isn't true of roughages. They're too bulky. I bought several silos within what I thought was hauling range last season. It wasn't practical, even though I got them at what would be considered right prices. Hay, of course, can be bought and hauled in, but transportation soon adds up to more than the hay cost at farm of origin and that makes expensive feed—too costly to put through beef cattle. So my big problem is roughage—production of it and a cheap, easy means of harvest."

He was ready for a field roughage harvester before any was on the market. Accordingly, when one of the implement manufacturers announced a small machine of 40-inch swath he was an immediate customer. But the company had manufactured only a limited number which were to be tested in various parts of the country, primarily at agricultural colleges under the scrutiny of experiment station and factory engineers. Mr. Dinklage convinced the manufacturers that he would make as good an experimenter as anybody. Further, he was ready to buy if the company would put a price on the little machine. They did and he took title with the customary guarantees for untried equipment.

"I want everybody to understand that this is strictly a test machine," he continued. "The company has sent a man here to make adjustments, confer on changes and to note any modifications that I have made."

Although the harvester is an experimental machine, he estimated on the basis of local custom charges for stationary silage cutters, 50 cents a ton, that the new

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equipment would have paid for itself by the end of the summer. Up to August 2, he had used it in ensiling 18 acres of first cutting alfalfa, 42 acres of second cutting, 20 acres of Sudan grass, 25 acres of barley and 5 acres of corn, a total of 500 tons.

"The corn harvest was an experiment," he explained. "The field was damaged by drouth and I wanted to compare silage made from it just in the shooting stage with silage made later when such corn is customarily harvested as a salvage measure. I got 5 tons an acre when I ensiled it. The rest won't make more than 2½ tons an acre 2 months from now. It's a question whether the tonnage sacrificed by waiting will be made up in feed value resulting from better maturity."

In estimating that the machine would pay for itself in one season on a sizable dairy or beef-making farm, Mr. Dinklage took no account of this obvious advantage which having such equipment on hand offered in salvaging a crop from weather or grasshopper damage, nor of the greater tonnage made possible by recovery of all leaves and finer parts. There is no chance for bleaching, leaching, molding or shattering losses. A neighbor had lost 30 acres of alfalfa hay to wet weather and was forced to move the worthless mess off his field to make way for the next cutting.

In case forage is made into hay, Mr. Dinklage recalled there was a chance for handling losses in raking, sweeping, stacking, hauling and feeding. Then after the dry roughage is in the mangers there is a further loss thru refusal. The same crop cut and processed directly from the sickle will avoid the handling losses and stock will eat every particle.

"I claim it will make 50 per cent more feed from a given acreage," he declared, "and that is a consideration that no man can ignore. It means I can supply my needs for roughage on fewer acres or since I am emphasizing roughage production for protection and improvement of my land, it means I can expand my beef operations with the same acreage and equipment. Any way you take it I reduce production costs."

The machine has a sickle, frame and front elevator similar to that of the small combine developed by the same manufacturer. The forage is reeled back on to the elevator, at the top of which it passes between feed rolls. The cylinder is equipped with 4 angle steel bars which barely clear a stationary cutting bar. The action is similar to that of a lawnmower. The cylinder is capable of 2,000 revolutions and that creates enough wind to carry the cut material through the upper elevator, against the hood and into the trailing wagon or truck. The elevator pipe is equip-

ped with a belt conveyor for keeping the silage moving when the forward pace and the cylinder slow.

Mr. Dinklage pulls the harvester with a 3-plow general-purpose tractor on rubber and the cutting and elevating machinery is operated by power takeoff. A 2-plow tractor would have power to operate the harvester, but it would be necessary, he considered, to load wagons lighter.

The crew consists of a man on the tractor, one on the wagon to level the silage, one to haul and one at the trench silo with another tractor to unload, pack, and attend the molasses pump, which, powered by electric motor, sprays the syrup over the silage. Two wagons are necessary and he has them equipped with rubber tires to insure light draft for the 2½-ton loads and to avoid damage to fields. Wagons likewise are equipped with stub tongues and an easily operated hitch which facilitates change from the harvester to the team-drawn cart with which wagons are hauled. Slings are used in unloading.

"We have ensiled 12 acres of alfalfa a day with it," he said, "but 10 likely would be a good average, or 50 to 75 tons of silage a day. My first cutting made 9 tons an acre, equivalent to about 1½ tons of hay. I doubt if putting up hay would be any faster, particularly with ordinary curing and drying time out. Four men will put up 40 acres of hay in about 3 days under normal conditions. And the feed won't be safe even after it is in the stack or mow. My crew of 4 put up 40 acres of silage in 4 days and in the trench there is no fire hazard.

"Of course if a man wants or needs hay, he can mow, rake and cure it, and the machine will chop it out of the windrow. He'll still be ahead in lower haying costs, in eliminating some waste and in saving mow space."

He asserts alfalfa silage is the best feed he ever used. Last season it was added to the steer ration 2 days after cutting. Yearlings and 2-year-olds are started on 20 to 35 pounds a day without ill effect. As finishing progresses and corn is increased they'll take less and less of alfalfa silage, as in the case of other silage. There is no evidence of washiness in his experience, as some feeders have reported where the legume silage was introduced later in the feeding period. Inasmuch as the alfalfa is high in protein, he reduced the allowance of concentrate by ½ to 1 pound a head daily.

Next season he expects to make 2 cuttings of sweet clover for silage. The crop is hard to cure if cut at the best stage for hay and too woody for good feed when it stands longer. Ensiling he considers the best method of utilizing it and the forage har-

vester affords the cheapest way of handling.

The Sudan ensiled last summer was cut when seed was in the soft dough stage and was 3 feet tall. Barley, cut in the hard dough stage, was converted into silage because it would supply more feed in that form than in any other and because that was the cheapest way to harvest it.

Guideposts for Hog Prices

Condensed from Hog Breeder

G. P. Collins

Oklahoma Agricultural Experiment Station

FARMERS adjust their hog production in response to price conditions; but, too often, they adjust too late. A prolonged period of high prices may encourage the farmer to increase his hog production only to find that other farmers have done likewise and that the pressure of new heavy supplies has depressed the price. To make maximum profits, the hog raiser, in common with other business men, must anticipate the price changes before they occur. The purpose of this article is to indicate some of the relationships which the farmer may profitably observe in anticipating price changes in the hog industry.

There are three general ways in which the farmer may operate his hog business from the viewpoint of price changes: (1) He may increase or decrease his hog production in response to price changes after they occur; (2) he may maintain a steady production regardless of price conditions; or, (3) he may adjust his production in anticipation of price changes.

Obviously the farmer who increases his production after prices have risen runs the risk of missing the favorable market. The producer who maintains an even tenor of production is not likely to experience such serious losses because of price changes. Extra gains in good times may tend to offset roughly the extra losses in bad times. However, few people who seriously consider the commercial nature of farming would now suggest that the farmer should maintain just as many hogs when prices promise to be unfavorable as when they promise to improve, even though the

Reprinted by permission from the Hog Breeder, Chicago, Illinois, Nov., 1940

livestock breeder may rightly advise the maintenance of adequate basic breeding stock. The farmer should adjust his hog production to take advantage of price changes. To do this he must anticipate the change so that he may be ready to profit from it.

Economic life is so filled with changeable factors that even the best trained men with the best available information would not be able to forecast prices correctly all the time. What, then, are the factors which the hog producer should watch most closely and how may he recognize the significance of these factors?

Research workers have demonstrated that important factors affecting year-to-year changes in hog prices are: (1) Changes in supply, especially hog slaughter; and (2) changes in demand, particularly as measured by (a) the purchasing power of domestic consumers, (b) foreign demand for United States pork and pork products, and (c) the prices of substitute products—particularly beef.

Indicators of the size of prospective hog supplies are: (1) the hog feed-price ratios; (2) the pig crop reports issued by the United States Department of Agriculture in June and December each year; (3) statistics in various government releases, such as the General Crop Reports, which may indicate unusual changes in the production set-up that will affect hog supplies; and, finally, (4) weather conditions, particularly at farrowing time.

The hog-corn price ratio is the most common indicator of the relationship between the price of hogs and the cost of feed. Because feed is an important element in the cost of producing hogs, this ratio indicates whether hog production is likely to be profitable or not. It simply shows the number of bushels of corn equivalent in value to 100 pounds of live hog at a given time. A high hog-corn ratio indicates that corn is cheap relative to hogs and is therefore favorable to the feeder. A low ratio, conversely, is unfavorable to the feeder.

Since a high hog-corn ratio is favorable to hog producers, farmers may be expected to respond to it by increasing their hog production. From about one to two years later, the result becomes very evident in increased hog marketings. These increased marketings, in turn, tend to depress the price of hogs; and when it becomes lower relative to the price of corn, the ratio again becomes less favorable. A decrease in hog production may be expected to follow. These interrelated conditions result in cycles of production. These production cycles are accompanied, in inverse direction, by price cycles. The hog cycle in the past has averaged about five years from peak to peak but has been sub-

ject to great variations. Many factors may be responsible for these variations, such as a sharp increase in the demand for pork, an unusually large corn crop and attendant low feed prices, or a change in the attractiveness to farmers of other farm enterprises as compared with hogs. Any one of these would interfere with the regularity of hog cycle, and consequently any farmer who is trying to plan his production in line with the cycle must take these causes for variation into consideration.

If figures on the hog-corn price ratio are not easily accessible, the farmer may determine in a subjective way at any time whether the relationship between feed costs and hog prices is favorable or unfavorable. He may similarly evaluate those factors which cause variations from the usual movement. The objection to such a method, of course, is that there is great room for error in judgment, but at least some systematic method of approaching the problem is preferable to haphazard conclusions.

The foregoing explains something of the general influence of hog-feed price relationships upon subsequent hog numbers and prices. However, the farmer may be interested in some more immediate relationship. At breeding time he may want some indication of whether there will be an increase in hog numbers. Research workers have discovered that the number of sows bred in the fall for spring farrowing is influenced very strongly by the hog-feed price relationship in the months immediately preceding breeding operations. When the hog-corn ratio between June and November has been, on the average, favorable, an increase in the number of sows farrowing in the following spring may be expected; conversely, an unfavorable ratio during this period may be expected to result in smaller spring farrowings. This early indication of what is likely to happen may be particularly valuable to hog raisers. The farmer has a further indication of what is happening to hog numbers in the pig crop reports issued by the United States Department of Agriculture in June and December. In addition to their direct help, the reports form an excellent tool for the farmer to use in checking the accuracy of his previous conclusions. The report's announcement of breeding intentions for the following pig crop gives the farmer still another opportunity to revise his plans if necessary. Experience over a number of years shows that the report on breeding intentions is an excellent index of the size of the slaughter when the next pig crop goes to market. However, excellent as the reports of breeding intentions are, they are not as early available as bases for planning as are the

observations from the hog-corn ratio in the pre-breeding season.

Other situations which may indicate changes in hog supplies are unusual shifts in the production program of any particular part of the country. For example, decreases in the production of cotton in the South-Central Region have been accompanied by large increases in hog production and vice versa. Hog production in the south-central region has become a much larger proportion of United States supply than it was in earlier years. It is therefore desirable for the farmer who is thinking about hogs to take into consideration the production in other farm enterprises, particularly in parts of the country where there appears to be some major readjustment in the farm economy.

Weather conditions also play some part in determining the size of a pig crop. For instance, the smaller number of pigs per litter in the spring crop this year has been due largely to severity of weather during the past winter, especially in the South.

Indicators of Changes in Demand

Supply is only one side of the hog price picture. The farmer should also visualize the present and prospective demand for hog production when planning his hog program and observe the close relationship between urban prosperity, as indicated by the index of payrolls in manufacturing industries, and prices of hogs. It is therefore desirable for the farmer to follow the movements of some index, such as the one cited, which indicates urban purchasing power.

As already indicated, the prices of substitute products will influence the demand for hogs, and so it becomes desirable for the man who is planning hog production to decide on what is likely to happen to such competitive meats as beef. And, finally, in assessing the probable demand the farmer should attempt to find some detailed analysis which will give him basis for estimating whether export trade in hog products will increase or decrease during the period in which he is interested.

The factors which have been cited above as affecting hog prices have not been advanced as infallible indicators. The thought has been that the farmer must of necessity make forecasts in planning his hog business and that he can do a better job if he has a grasp of the more important factors which may be expected to influence prices in the future, even though he may not be able to make an exact analysis of these factors.

Controlled Atmosphere Storage

Condensed from American Fruit Grower

Richard T. Meister

EARLY in the year 1921 at Histon, England, two men tugged at a siding shutter in a heavy wooden door and peered anxiously through the window they had just opened.

In the half light of the interior they could dimly see neatly stacked boxes and trays containing apples within oiled paper wrappers. After reaching inside, one of the men pulled out a Bramley's Seedling apple, juicy and firm. "I say," he exclaimed to his companion, "look how well these fellows keep!"

The two men were Franklin Kidd and Cyril West, pioneer research workers in the development of gas storage of fruit in England, which has been adopted in this country as controlled atmosphere storage.

They had just opened a semi-commercial eight-ton capacity gas storage and found to their joy that previous tedious experiments on a small scale had justified the erection of the first semi-commercial gas storage.

Conservatively, in true English style, they later wrote of their experiment: "On the whole the experiment was a success in the commercial sense. The fruit retained its greenness, firmness and juiciness to a remarkable extent. The prices obtained were good, and reports received concerning the appearance and condition of the fruit flattering."

This was but the first chapter in the amazing history of gas or controlled atmosphere storage which even today—20 years after the first trials at Histon, England —is yet incompleted.

What exactly is controlled atmosphere storage? Why does it make apples keep longer? What are the gases used in this type of storage? Will controlled atmosphere storage some day take the place of cold storage? These are all pertinent questions that the uninformed reader anxiously asks in order to find how controlled atmosphere storage will affect him and his business.

To understand perfectly how this type of storage works, the grower must first realize that the fruit is a living organism which continues to live even after being removed from the tree. The fruit breathes, gives off carbon dioxide and takes in oxygen. This process of respiration consumes the food stored within the fruit and when all the food is exhausted

Reprinted by permission from the American Fruit Grower, Cleveland, Ohio, Nov., 1940

the fruit loses quality and value. In other words, the fruit dies.

But if the fruit is put to sleep directly after being picked, the breathing process slows down, food is used more slowly, and storage life is increased.

Lowering the temperature is one way to slow down the rate at which fruits live. Apples, for example, at 35 degrees F. breathe at one-fifth the rate they do at 70 degrees F.

Controlled atmosphere storage similarly slows down the fruit's life processes. Carbon dioxide, which accumulates in the storage room, is used as an anesthetic to put the fruit to sleep. Also in some types of controlled atmosphere storage, the percentage of oxygen in the air is decreased, which gives the fruit less "tinder" so that the living process is further slowed down.

Controlled atmosphere storage does not apply equally well to all varieties of apples. In fact, some varieties do not store well at all in this type of storage.

American investigators have obtained remarkable results, however, with the McIntosh apple. By reducing the oxygen to two per cent, raising the carbon dioxide to five per cent, and keeping the temperature at 40 degrees F., it was found by Dr. R. M. Smock and A. Van Doren, at Cornell University, that McIntosh could be stored until June or July. In regular refrigerated storage without carbon dioxide they kept only until February.

On May 10, 1940, a truckload of McIntosh apples stored in controlled atmosphere storage at Cornell was shipped to New York City. The apples brought the top price on the market, $2.25 a box. The request was wired back to Cornell, "Ship all your apples and quote your own price."

Because of the promising results Cornell workers obtained with the controlled atmosphere storage of McIntosh, several growers in New York State have built similar storages for their McIntosh apples.

Results with other apples have not been so promising. At Cornell it was discovered that Rhode Island Greening will not keep well in controlled atmosphere storage because it is particularly susceptible to scald which is more prevalent in controlled atmosphere storage than in regular refrigerator storage. Northwestern Greening gave more promising results because scald can be controlled. Twenty Ounce keeps well in controlled atmosphere storage, and Cortland also stores well but is susceptible to scald.

In California, Yellow Newtown apples grown in the Pajaro Valley store well in controlled atmosphere storage because it is not necessary to keep storage temperatures as low in this type of storage as in regular cold storage. Thus the low temperature

trouble, internal browning, to which Yellow Newtown is especially susceptible, can be avoided.

Long-time controlled atmosphere storage with stone fruits has not been promising because the high percentage of carbon dioxide causes injury. However, short periods of exposure to carbon dioxide were found to retard softening and coloring.

With strawberries and raspberries, it was proved that carbon dioxide gas retarded decay and kept the berries firm and bright.

Some pear varieties store remarkably well in controlled atmosphere storage. A 20-week increase in storage life may be expected if proper atmosphere concentration and proper varieties are used.

Growers must realize that controlled atmosphere storage is a modification of refrigerated storage, not a substitute. With controlled atmosphere storage, the same amounts of refrigerating equipment and insulation are needed as in refrigerated storage. Although temperatures are usually kept higher in this type of storage than in refrigerated storage, it takes as much refrigerating equipment to pull the heat out of the fruit when the apples first enter the storage room.

Also, an additional cost is involved because the storage must be absolutely airtight so that proper concentrations of oxygen and carbon dioxide may be maintained. Controlled atmosphere storage increases the cost per bushel as much as 10 cents over refrigerated storage.

There is no expense for carbon dioxide because living fruits naturally give off carbon dioxide in sufficient quantities. With McIntosh, which is stored in an atmosphere of five per cent carbon dioxide and two per cent oxygen, after the storage is closed and is airtight, it takes three to five days for carbon dioxide to build up to five per cent. After that the air in the storage room is run through a "scrubber" which removes excess carbon dioxide from the air and keeps the concentration steady at five per cent.

As the fruit gives off carbon dioxide, it uses up oxygen so that the percentage of oxygen in the storage air steadily decreases. In one to two weeks, the oxygen content of the air is reduced to two per cent. To replenish the oxygen supply, the storage is ventilated once every three to four days.

What, now, are the disadvantages of controlled atmosphere storage? What are the hidden flaws which the average grower cannot see unless he makes a thorough investigation of this type of storage?

Briefly, there are four disadvantages:

1. Controlled atmosphere storage is not universally applicable

to all fruits or to all varieties of one fruit.

2. The storage room cannot be entered at the grower's convenience. It must remain airtight until the apples are taken out. If the operator attempted to enter he would be in danger of suffocation.

3. It is difficult to make buildings airtight, which means added cost over regular refrigerated storage.

4. Hazard of storage scald is increased because of poor ventilation. This necessitates the use of oiled paper to prevent scald.

There are also four main advantages to controlled atmosphere storage besides the all-important fact that it makes apples keep longer.

1. Low temperature troubles like brown core, internal browning, soggy breakdown, soft scald and brown heart are avoided because higher temperatures in the storage are used. For instance, 40 degrees is the standard temperature for McIntosh.

2. Change of ground color from normal green to yellow in apples and pears is retarded.

3. The high concentration of carbon dioxide has an inhibiting effect on the growth of molds.

4. There is a great residual effect so that even when the fruit is taken from controlled atmosphere storage it keeps better than fruit taken from cold storage.

At present, controlled atmoshere storage is a specialized treatment for certain varieties of fancy apples, as only those apples which will bring a high price on the market may profitably be put in this modification of regular refrigerated storage.

What the future will bring, what additional chapters will tell, depends on the diligent investigations of men like Kidd and West, Smock and Van Doren, Allen, of California, and a host of other workers, all of whom are spending long hours of research trying to perfect controlled atmosphere storage of fruits.

Gas storage was first named by the English workers Kidd and West, who did not foresee the misunderstanding which would arise from the use of such a term because many people naturally associate gas with harmful effects. Because of this, and because oxygen as well as carbon dioxide is controlled in the American technique, it was considered advisable by research workers in the United States to change the name gas storage to controlled atmosphere storage. — Editors, American Fruit Growers.

Drouth Resistance Is Inherited

Condensed from The Nebraska Farmer

DROUTH resistance in corn is inherited, and seed corn that is reliably drouth resistant probably can be assured by controlled crossing of inbred lines that have previously produced drouth-resistant hybrid seed.

That is one of the immediately practical findings of a study of corn genetics related to heat and drouth tolerance by E. C. Heyne and Arthur M. Brunson, of the Bureau of Plant Industry. There is no indication in these experiments that the crossing of two inbred lines of drouth-resistant corn will increase drouth resistance in the same way or to the same degree that other qualities —yield for example—may be increased by crossing inbred lines to produce first generation hybrids for seed. The studies also indicate that it is not probable that breeders will ever be able to develop sweet corns as drouth resistant as the hardiest of the starchy corns.

Heyne and Brunson have been working in greenhouses at the Kansas agricultural experiment station, where for the last few years conditions in the field have been unusually favorable for checking greenhouse results by means of field plantings. They have applied the earlier discovery that it is possible to get a fairly reliable indication of drouth resistance of corn by exposing seedling plants to several hours of extreme heat—at about 130 degrees Fahrenheit—in a chamber where the humidity is only about 30 percent. Seedlings that survive such treatment and recover from the effects come from strains of corn that prove highly resistant to both heat and limited soil moisture when planted in the field.

By "heat testing" of seedlings in the greenhouse in winter the experimenters are able to gain at least a full season in the progressive development of a breeding program of this type. If fields are not stricken by drouth the following summer, the gain is even greater, because the crosses indicated as desirable by the seedling tests can be made in the field under favorable conditions and the checking of results can be resumed in the greenhouse the following winter. In some cases the greenhouse tests have been able to distinguish superior drouth resistance in one of two strains that had appeared to do equally well in the field.

Crosses of the more drouth-resistant strains of inbreds re-

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sulted in resistant hybrids—some slightly more resistant than either of the parent stocks. Crosses of resistant and susceptible strains usually gave intermediate resistance, but a backcross with the resistant parent usually improved the resistance. In general, the investigators were encouraged to find that drouth resistance was more likely to prevail than drouth susceptibility—that there is a tendency toward dominance in many of the factors that make for drouth resistance. This, it is anticipated, will favor the breeding of corn adapted to areas where drouth has made corn growing hazardous in drouthy periods.

The Heyne and Brunson studies have also included "genetic analysis" of five of the inbred Kansas strains most resistant to drouth. Genetic analysis is a complicated scientific procedure that involves several related procedures: (1) crossing of the corn under test with other inbred lines with distinctive characters that have been studied previously; (2) growing the hybrids; (3) comparison of the growing plants with the parent strains; (4) study of the plant cells under the microscope to observe variations in the chromosomes; and (5) mathematical computations that help interpret the findings and establish relationships between associated characters.

Analysis of hundreds of crosses including one of the Kansas strains as one parent make it clear that drouth resistance is not a simple character that may be isolated readily in true-breeding strains. Drouth resistance, Heyne and Brunson find, is the result of a complex combination of qualities governed by hereditary factors that exist in at least six of the ten "linkage groups" that corn breeders have identified.

"Sweetness" in corn is governed chiefly, if not exclusively, by the "sugary gene" located on one of the chromosomes. The analysis indicates that this gene is linked with others that make corn susceptible to drouth injury—and this makes improbable the breeding of sweet corns as drouth resistant as may be possible with the starchy corns.

In most cases crosses of the heat resistant inbreds resulted in the increased vigor that makes the first generation cross valuable for seed corn, but Heyne and Brunson report that "hybrid vigor, in itself, apparently does not make a cross resistant to heat, at least in the seeding stage." Their result indicates that it will be possible to breed corn more resistant to drouth, but that the process is likely to require years of continuing effort in concentrating drouth resistance through repeated inbreeding and recombination of resistant lines. It is not likely to result from a single fortunate crossing that "clicks."

Their work on genetic analysis for drouth resistance is continuing and the detailed findings they report are expected to aid other experimenters in making further gains in the building of drouth resistance.

Changing Cotton Markets

Condensed from The Nation's Agriculture

Arthur W. Palmer

PROFOUND changes have marked the world's cotton enterprise during the last 25 years. World crops increased as new fields were brought into production. New fibers came on the scene to crowd millions of bales of cotton out of accustomed uses; but, in spite of the new competition, consumption of cotton in the world increased by a third. . . .

Probably the most significant feature of the last quarter century has been the great growth of national self-sufficiency throughout the world, both in raw cotton and in texiles. Many countries which were formerly importers of cotton textiles have accomplished by various means the establishment of textile industries capable of supplying partially if not wholly the needs of their own populations. . . .

Conversely, countries primarily industrial, equipped with well established textile plants, have quite generally intensified their efforts to develop new sources of raw material within their empires whenever indeed they have not been able to do so within their own borders. When in recent years progress in this direction could not be made with satisfactory rapidity, a number of the more important consuming countries have sought to attain a greater degree of self-sufficiency, first by stimulating the production of rayon and other synthetic fibers and then by compelling their people to use more goods made from them in substitution for cotton goods. . . .

Just before the outbreak of war in 1914 the mills of the world used annually about 21 million bales of cotton or a little more. Of that amount about 13 million bales had to be imported from other countries. Twenty-five years later the world seemed to have grown accustomed to using at least 28 million bales but imports were still only about 13 millions. At the beginning of the period only about 8 million bales were spun in the country of their growth. In the end, the quantity of cotton so spun had been nearly doubled by the addition of all

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of the 7 million bales by which total world consumption had increased.

Even more remarkable is the story of cotton goods. In the calendar year 1913, it is estimated that cotton to the amount of about 6¼ million bales was exported in the form of yarn and cloth from the countries in which it was processed to consuming countries less developed industrially. By 1937—the best of the years immediately preceding the European war—though consumption of cotton had increased by about 7 million bales, world exports of yarn and cloth had fallen to the equivalent of something less than 4 million bales of cotton.

These facts throw light on the position in which American cotton growers now find themselves. Of the two countries which originate the bulk of the world's exports of yarn and cloth—the United Kingdom must import all, and Japan nearly all, of the cotton used. A decline in the export trade of either country is reflected at once in its requirement of raw cotton. For example, Great Britain before 1914 was importing about 5 million bales of cotton, of which roughly 1 million were needed to supply Britain's own population, 500 thousand were re-exported, and close to 3½ million passed through British mills and out of the country to supply the needs of consumers in other lands. India alone took about a third of all these exports. Under such conditions, roundly 3¾ million bales of American cotton—more than the total exports from the United States to all countries in 1938-39—could readily be sold in Great Britain. But by 1939 growing self-sufficiency had taken all but a remnant of the goods market in India and had made deep inroads in the trade elsewhere. To supply her total domestic and export demand Britain was then requiring little more than 3 million bales altogether, and was taking from the United States average yearly imports of only about 1¼ million bales.

The loss of 2½ million bales in the annual sales to Great Britain is the severest single blow that American cotton growers have sustained in 25 years. For some years however, the effect of Britain's ebbing demand on the total of American export trade was concealed by the rise of exports to the Orient. Japan's mills, which before 1914 had seldom needed more than 400,000 bales of American cotton, increased their takings gradually until in the early thirties they were close to 2 millions. This increase corresponded with gains in Japan's exports of cotton goods, part of which was at the expense of British trade. But lately Japan in her turn has felt the pressure of growing self-sufficiency in her

customer countries, and has seen the trend of her exports turn downward. By 1939 exports from the United States to Japan had fallen about to the level of 850,000 bales a year—less than half the volume a few years before. In the case of Japan, however, American cotton exports have suffered from growing self-sufficiency even more within Japan itself than in Japan's overseas markets. Japan is one of three great users of cotton which have sought to achieve a high degree of self-sufficiency by requiring their own people to use home-produced rayon in place of imported cotton. Germany and Italy are the others.

In 1913 the total amount of rayon produced in the world barely more than equalled the weight of 50 thousand bales of cotton. By 1939 it had increased almost a hundredfold to 4.7 million bales. Certain characteristics can be noted in the countries in which the greatest gains have taken place—United States, United Kingdom, France, Germany, Italy, and Japan. These countries stand relatively high in the scale of living standards; they are primarily industrial in their economies, and (with the exception of the United States) they are generally dependent upon imports for their supplies of raw cotton. A fourth feature, and one to be particularly noted, is that the three countries which lead in the use of rayon—Japan, Germany, and Italy—have enforced the substitution of rayon for cotton by law.

In 1939, the combined production in these countries of filament yarn and staple fiber together was nearly two-thirds of the world's total, and equalled the weight of more than 3 million bales of cotton. Germany, which in the 3 years before 1914 took about 2¾ million bales of cotton from the United States alone, has managed since 1933 with less than 1¼ millions from all sources. Italy was taking less cotton just before the second World War than before the first; and in Japan, with all her unique gains in textile exports, cotton imports had receded to about the levels of the early 1920's. Cotton's gains of a quarter century have been in countries formerly less advanced industrially—principally India, Russia, and China—all, of course, important cotton producers.

The United States might count itself fortunate had its opportunities to export cotton been limited only by the failure of total world exports to expand in a quarter century; but as matters have developed, competition among cotton-growing countries for shares in the total of world export trade has also greatly intensified. . . . Brazil, Argentina, Peru, Mexico, Iran, Egypt, the Sudan, the British colonies and Mandated

territories of East and West Africa, the Belgian Congo and other countries in lesser degree have pressed for, and gained, larger shares in the world's trade at the expense, primarily, of the United States. Thus, while in the five years 1909 to 1913 the United States contributed on an average about 8.8 million bales to the known total of about 12.9 million bales of world cotton exports—that is to say about 70 percent—from 1934 to 1938 the United States' share was but 5.3 million bales or about 40 percent. Conversely, the share of foreign countries in the same time increased from roundly 30 percent to 60 percent.

Twenty-five years ago the world market for cotton was for practical purposes a free market. In raw cotton, quality and price were the factors generally governing competition; on cotton goods, tariffs in the principal importing countries were not very considerable. But in this respect, also, great changes have taken place. Tariffs have been raised in many countries. . . . By such arrangements as the agreement with Japan of 1934, since renewed from time to time, and that with the United Kingdom of 1939, India has sought to shelter her position in the cotton export markets by granting duty concessions on imports of cotton goods from the two countries, conditioned upon their taking certain minimum quantities of her raw cotton. Egypt has had under consideration a plan to grant quotas for the import of cotton goods from each of a number of countries proportioned on the share of each country's takings in her exports of raw cotton.

Consuming countries also have contributed to the change. Germany, since 1933, has secured the major part of her cotton supplies by barter arrangements of one kind or another. Italy in recent years has allocated foreign exchange for the purchase of cotton from the proceeds of exports of cotton goods. Japan, designating this device the "link-system," has applied similar measures since July, 1938. Competition in cotton goods has been further regimented by duty concessions in the British Dominions, import quotas in the crown colonies, and restrictions of various kinds in such important markets as Argentina, Egypt, and the Netherlands East Indies.

In the United States, rising living standards were attended by an increase in per capita consumption of cotton up to the time of the World War, but since that time there has been no further gain, if indeed cotton has quite held its own. A population increase, however, from 96.5 millions in 1913 to 130.2 in 1938 has increased the total domestic demand. American mills, which on the eve of the World War used

only about 5 to 5⅓ million bales (including a substantial amount exported as goods), raised their consumption to an average of 6⅓ millions in the five years ended with August, 1939, and reached over 7¾ millions in 1936-37—a record high level up to that time. Exports of textiles meanwhile had been much reduced.

An important change in the United States, however, was the continued shift of mills away from the New England States to the cotton growing States of the Southeast. In 1913, 2.9 million bales—slightly over 52 percent of the cotton used in the United States that year—was spun in cotton-growing States. In 1939, the South's consumption had more than doubled to 5.8 million bales, and the percentage was 85. This shift, important from the industrial and civic standpoints, has also certain important implications for agriculture. It means that cotton States east of the Mississippi River, which 25 years ago contributed substantially to the total of cotton exports, have not for some time done so and now find all but a small fraction of their market in the Carolinas, Georgia, Alabama, and Virginia. By the same token, States west of the River, some of which once shipped considerable amounts of cotton coastwise to New England, find themselves at a comparative disadvantage with their eastern neighbors in point of the freight-haul to the southeastern mill centers, and with their interests consequently more than ever identified with exports.

Toward the world situation, however, cotton growers whether of the eastern or western belt have much the same outlook. The buoyancy and expansion of the great world market for American cotton which characterized the scene in pre-1914 years are, at least for the present, gone. In their place are self-sufficiency over large areas, new competition, restricted markets, and huge surpluses which a growing home consumption can only slowly reduce. The present war has brought no genuine relief but rather an intensification of these problems. . . . It remains now to be seen if, in the post-war reconstruction ultimately to come, ways cannot be found to meet the basic difficulties in the world situation. We should not assume that the situation is hopeless because it is dark today.

The Soybean — Its Meal and Its Cake

Condensed from The Cattleman

K. J. Maltas

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WHILE soybeans are a new crop in America, they are in reality a very old crop, as they have been used for both livestock and human food in the Orient for over fifty centuries. Soybeans were first brought to America in 1804, but they were of no commercial importance until after the first World War.

Until 1920 soybeans were grown primarily as a hay crop, or as a green manure crop to increase the fertility of run-down land. The first commercial processing of soybeans of importance in America, started in Illinois in 1922. While all of the original seed stock came from the Orient, many new American varieties have been developed in the past twenty years. There are thousands of varieties of soybeans, but the popular beans for milling are confined to five or six yellow seeded varieties.

Yellow varieties are preferred to all others by processors, because they produce an oil that is more easily refined and they produce a soybean oil meal that is an attractive golden yellow color, which meets with ready acceptance from the feed buyer.

While Soybeans have been grown in wide range of soil types and climates, they do best, where corn does best. The important soybean states are Illinois, Iowa, Indiana and Ohio. These four states produce about 90 per cent of the commercial crop. New crop shipments of meal and pellets begin each year in early October.

The primary products produced from soybeans are soybean oil meal, and soybean oil. A great many other products are produced from soybeans, but these are of minor importance.

Much publicity has been given to the fact that soybean oil meal is used in making various plastic material, automobile parts, glue, paper coating, etc. However, only about 5 per cent is used for these purposes while more than 95 per cent of all soybean oil meal produced in America is used for livestock and poultry feeding.

The growth of the soybean industry has been little short of phenomenal. The soybean oil meal production figures for the

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past several years clearly indicate the amazing growth of the industry.

1922-23	1925-26	1929-30
3,800	8,500	40,000
1934-35	**1938-39**	**1939-40**
223,000	1,000,000	1,300,000

For the past fifteen years cottonseed meal production has averaged around 2,000,000 tons annually and linseed oil meal about 500,000 tons. The production of these two products has remained fairly constant, while soybean oil meal production has grown from almost nothing fifteen years ago until today it is about three times as large as linseed meal production and two-thirds as large as cottonseed meal production in the United States. Soybean oil meal has not stolen any market as is sometimes accused. It has helped to fill a new market demand.

The most encouraging thing about this phenomenal growth in soybean oil meal production is that consumption has more than kept pace with production. There has never been a carry-over from one crop to another. Practically every large feed manufacturer in the United States today is using soybean oil meal, in all or part of his mixed feed formulas. Soybean oil meal is now being sold in every state in the Union, most provinces of Canada, and in the past considerable has been exported to Europe. From reports, I understand that several thousand tons of soybean pellets have been sold in Texas already for shipment on the new crop movement.

Reason for Growth

There are several reasons for this rapid increase in soybean production. We believe they are:

1. A decided trend over the entire U. S. toward better feeding practices. Thus more protein concentrates are required. Livestock men are fortunate that soybean oil meal came into prominence, or concentrates would be much higher.

2. Diversification of agriculture—less corn acreage in North and less cotton acreage in South.

3. The real merit of soybean oil meal as a protein concentrate.

Tests conducted at leading state experiment stations during the past fifteen years have proved conclusively that soybean oil meal, when properly processed is an excellent protein supplement for all classes of livestock and poultry, including dogs, wild game, etc.

Let me read a few statements from agricultural experiment stations:

Beef Cattle: Two-year-old steers receiving soybean oil meal with a basal ration made an average daily gain of 2.91 pounds while similar cattle receiving cottonseed meal and the same basal ration gained 2.77 pounds.—Illinois Experiment Station.

Dairy Cattle: Extensive feeding experiments have been conducted in the United States and several European countries comparing soybean oil meal and soybean cake with cottonseed meal and linseed meal as a protein supplement in the dairy ration. Soybean oil meal has been found equal or superior to cottonseed meal and linseed meal for milk and butterfat production.—United States Department of Agriculture. Farmers Bulletin No. 1617.

Poultry: For growth and egg production, soybean oil meal supplemented with minerals appears to be about equal to meat scrap and fish meal, somewhat better than tankage, gluten feed and cottonseed meal and not quite so good as dry milk products.—Illinois Agricultural Experiment Station.

The Pennsylvania Station found soybean oil meal could be used to replace a considerable part of meat products and milk in turkey rations with excellent results.

Sheep: Soybean oil meal produced slightly larger gains on lots of twenty-five lambs than did cottonseed meal and the cost per hundred weight gain was somewhat less.—Purdue University Experiment Station.

Hogs: When minerals are included in the ration, good quality soybean oil meal gives fully as good results as tankage or linseed oil meal when fed with grains to growing or fattening hogs.—Ohio Experiment Station.

Is Range Feeding Necessary?

From experiments conducted at Texas, Nebraska and New Mexico Experiment Stations, it appears that the practice of supplemental feeding on the range is a profitable procedure. Whereas many ranchers used to feed protein concentrates in the winter only to keep their herds from starving, great number of ranchers now winter-feed regularly because they reduce death losses in cow herds, produce a more uniform and larger calf crop, and get more value out of their range grasses and hays.

Animal's Requirements

In order to do a good job of feeding, it first is necessary to understand an animal's requirements. An animal requires six nutrients—protein,carbohydrates, fats, minerals, vitamins, and water. A cow must have these six nutrients in rather definite proportions because each one performs a somewhat different job in the animal's body.

Value of Protein Concentrates

Why has soybean oil meal become a very popular protein concentrate for all classes of livestock? There is no miracle about this. There are basic reasons why it should do a good job. Without going into a lot of detail, we perhaps can best picture the reason for the popularity of soybean oil

meal by taking a look at the factors that determine the value of any protein concentrate.

It has been and still is quite customary for both buyers and sellers of feed products to judge the value of protein supplements almost entirely on how much protein they contain. The fallacy of this "measure of value" is realized when one recalls that leather is practically all protein—and at the same time practically indigestible—and thus worthless as a feed.

There are eight or nine major values which should be considered when selecting a protein concentrate—instead of just one factor. These factors are:

1. The amount of protein it contains.
2. The quality of the protein.
3. The digestibility of the protein and other nutrients.
4. The palatability of the product.
5. Its ability to produce a good product, such as beef.
6. Its physical effect on the animal.
7. The availability of the product—large annual tonnage.
8. Its economy.
9. Its adaptability to all ages and classes of livestock.

Soybean oil meal probably meets these nine requirements better than any other single protein concentrate. There are many mixed feed supplements which will meet these requirements in excellent shape, but in this discussion I am referring to single protein products only:

Ability to Quality

Requirement No. 1—Soybean oil meal is classed, of course, as a high protein concentrate. The average analysis of soybean oil meal is as follows:

Protein	**41-44%**
Fat	**½ to 4½%**
Fiber	**7%**
NFE	**30%**
Mineral Matter	**6%**

As you can see from the analysis, it ranks very well in Requirements No. 1; that is, it is high in protein.

Requirement No. 2—Quality of Protein. Protein is a complex material made up of component parts called amino acids. Twenty-two distinct and separate amino acids are known. Ten are considered essential and twelve nonessential. By essential, we mean those that an animal cannot manufacture from other proteins, but which must actually be supplied in the feed. Grains and grasses generally lack one, two or three of the essential amino acids or contain them only in very small amounts. Therefore, in selecting a protein concentrate it would be well to pick one that contains all the essential amino acids in relatively substantial quantities.

Table No. 1 shows the amounts of the essential amino acids contained in the primary protein of corn, soybean, milk, and meat.

Table No. 1

COMPARISON OF PROTEINS

Essential Amino Acids	Corn (Zein)	Soybeans (Glycinin)	Milk (Casein)	Ox (Muscle)
Lysine	0.0	9.1	7.6	7.6
Tryptophane	0.2	1.7	2.2	1.2
Histidine	0.8	1.4	2.5	1.8
Phenylalanine	7.6	3.9	3.9	3.1
Leucine	25.0	8.5	9.7	11.6
Isoleucine	undetermined	undetermined	undetermined	undetermined
Threonine	undetermined	undetermined	undetermined	undetermined
Methionine	undetermined	undetermined	undetermined	undetermined
Valine	1.9	0.7	7.9	0.8
Arginine	1.8	8.1	3.8	7.5

You will note that the proteins of soybeans, milk and muscle are surprisingly similar and quite different from the protein of corn. This illustrates graphically how the protein of soybean oil meal supplements the protein of grains or grasses and hays. The absence, or limited supply of any of the essential amino acids will limit the proper functioning of the animal's body. The similarity in quality between the protein of soybeans and milk and muscle clearly illustrates one reason for its high biological value.

Thus, it is important not only to supply sufficient protein, but even more important to supply protein of good quality.

Requirement No. 3—Digestibility. The protein of soybean oil meal is considered by leading authorities to be about 90 per cent digestible. This is much higher than most other protein concentrates.

The other nutrients in soybean meal are also from 90 per cent to 95 per cent digestible.

Requirement No. 4—Palatability. A good quality soybean oil meal is very palatable to all classes of livestock. I have had range men tell me that soybean pellets are too palatable, because the cattle practically trample them to death while they are scattering the pellets on the ground.

Requirement No. 5—Ability to Produce a Good Product. Soybean oil meal produces excellent quality beef, pork, eggs, etc.

Requirement No. 6—Good Physical Effect on the Animal. In the corn belt feed lot, linseed oil meal has long had a reputation for putting a finish and bloom on cattle and keeping livestock in condition. This has been attributed by linseed oil meal manufacturers to the vitamin F kö which linseed oil meal contains. Linseed oil meal manufacturers have explained that vitamin F is in reality linoleic and linolenic fatty acids, which are contained in linseed oil. Soybean oil is a very good carrier of these

two particular fatty acids, and many large cattle feeders believe soybean oil meal will put as good finish and bloom on cattle as linseed oil meal.

Requirement No. 7—Availability of Product. Due to the rapid growth in the soybean industry, soybean oil meal is available the year round. A production of 1,300,000 tons last year makes it the second largest vegetable protein concentrate on the market.

Requirement No. 8—Economy. For the past several years soybean oil meal has sold well in line with other protein concentrates. with increasing production each year, it would appear that this would continue to be true.

Requirement No. 9—Adaptability to All Ages and Classes of Livestock. Soybean oil meal is being fed to all classes of livestock and poultry, including dogs and wild game. It can be fed to the youngest and oldest animals, with excellent results. If desirable, it can be fed in large amounts without damage.

Feeding Soybean Meal on the Range

Soybean oil meal has been giving such universally good results in corn belt feed lots and in experiment station tests that about six years ago soybean processors began to get inquiries from the range country. In order to determine exactly what the rancher needed and wanted, some soybean processors spent considerable time visiting with ranchers and experiment stations before attempting to produce a product for range feeding.

It was soon determined that soybean oil meal would have to be pelleted for range feeding, because soybean cake as it comes from the mill is too thin and brittle for feeding on the ground. As a result, machines were installed and pellets were made into desirable sizes for calves, cows and sheep for ground feeding and also in small sizes for trough feeding of cattle, and calves. After considerable experimentation soybean processors learned how to make the pellets hard enough to prevent shattering and yet not too hard but what a cow can readily chew them.

Soybean oil meal pellets are yellow in color and thus they can be readily seen on dry ground or on the snow. Most of the soybean oil meal pellets on the market are mineralized. Experiment stations show that in most of the range areas additional minerals are needed beside those supplied in grasses, hays, and grains.

Phosphorus seems to be especially needed. Since it is very difficult to feed minerals on the range, the soybean oil meal pellet manufacturers have incorporated phosphorus carriers in their pellets in quantities generally considered adequate. Some calcium is also incorporated since some areas also require this prod-

uct. As far as I know, salt is not included in any soybean oil meal pellets, since salt can be supplied in blocks or troughs by the rancher quite readily.

The amount to feed will vary a lot with the weather, the condition of the range, and the size and age of the cattle. Generally, from ½ pound per head daily on calves to 1¼ to 2 pounds per head daily on breeding herds is considered adequate.

Under drouth conditions I have seen cattle fed from five to nine pounds per head daily of soybean oil meal pellets. In one particular instance in Nebraska, I knew of several hundred head of steers that were fed five pounds of pellets per day on burned-up pastures, and when they came off the pastures in September many experienced cattlemen stated that they looked as if they had been grain-fed for from 60 to 90 days. One rancher in Nebraska who was experimental-minded, fed 15 pounds per head daily of soybean oil meal pellets on dry pastures, to see how much they would eat and to see if this high protein feeding would hurt them, and he reported that they came along in excellent shape.

This extremely high feeding of protein supplement would not be economical under ordinary conditions, but at this particular time soybean oil meal pellets could be bought in Nebraska at about the same price as corn, and of course, they were a lot easier to feed on the range.

Thousands of cattle and sheep ranchers have used soybean oil meal pellets with excellent success during the past six years. I have seen letters from ranchers stating that they have been highly pleased in every respect with the product. You will find that soybean oil meal pellets have been giving a good account of themselves in range feeding from Texas to Montana, and from Nebraska to Oregon.

Winter Care of the Tractor

Condensed from The Michigan Farmer

R. U. Blasingame

DUE to unfavorable conditions for operating the tractor in low winter temperatures, attention to the following points will insure easier starting and better operation.

Fuel does not vaporize as freely in winter temperatures as in summer. We advise the use of high test gasoline for starting in low temperatures.

Liberal use of the choke will be necessary when starting; however, never leave the choke completely closed for more than two complete revolutions of the crank shaft. The choke must be gradually opened until when the engine is warm, the choke will be wide open. You will otherwise have excessive fuel consumption and the oil will become diluted with gasoline or distillate.

The radiator may be partly covered in winter. A piece of cardboard 8 inches high placed between the radiator and grill is usually sufficient. It may be higher in extreme winter weather.

Filling the radiator with warm water will aid in easy starting during cold weather.

Using An Anti-Freeze

If there is to be any considerable use of the engine during freezing weather, you might fill the radiator with an anti-freeze solution so you need not drain the radiator whenever the engine is stopped. Use these solutions in accordance with the manufacturer's recommendation.

Water and alcohol solutions cannot be used for cooling, as the temperature of 178°F. will quickly evaporate any water and alcohol solution. If the use of any anti-freeze is desired, Prestone, glycerine solutions, or other kinds of anti-freeze solutions which do not evaporate at such a low temperature as alcohol can be used.

When water is used it should always be drained to prevent freezing when the engine is stopped for any length of time. The engine should be immediately started directly after the radiator has been filled; also, the radiator front should be covered with the curtain until the water temperature reaches 178°F. When the engine is permitted to idle, or operating on a light load, the radiator should be partly covered with the curtain.

Many tractors are provided with the thermostats which will maintain a uniform temperature for the best results, but in cold

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weather it is necessary to use the curtain to prevent the water from freezing in the radiator before the thermostat opens, which does not occur until the temperature of the water in the cylinder block reaches 178°F.

It is very important, when using low cost fuels, to run the engine on gasoline a sufficient time until the water is heated to 178° F. before turning on the low cost fuel.

Lubricating oil used in winter should be of a lighter grade than that used in summer. Be sure and let the engine warm up so that the lubricating oil flows freely to all working parts before putting the engine under load.

If you are to use the tractor during winter weather, pour a sufficient amount of light engine oil in the transmission and final drive gear cases so that the oil will follow the gears when they revolve. Don't fail to change oil to S.A.E. 140 when spring comes.

Change Oil Frequently

It is most important in the winter time to drain and change engine oil regularly as hot and cold temperatures in the tractor cause condensation and collection of water in the crank case. If the water is left in the crank case to freeze, the oil pump drive may fail and bearings will be ruined by lack of oil.

For cool weather of spring and fall, with temperature ranging from 32°F. to 50°F., use an oil having a body viscosity of S.A.E. No. 20.

For cold weather having a temperature ranging from 32°F. to zero and below, use an oil having a body or viscosity of S.A.E. No. 10. In cold weather it is important that the oil has a low pour point, or cold test, so that it will flow freely and permit easy cranking when starting.

In cold weather many operators drain the lubricating oil after each day's run and put it in a warm place, and then refill with this warm oil. In exceedingly cold weather this practice is to be recommended. If the above recommendations of draining the oil in cold weather are not followed out it will be necessary to loosen the oil pan drain plug daily, after the tractor has been standing a couple of hours, and see if it contains any water. It is not necessary to remove the drain plug, simply back it up until but one or two threads are holding and if crankcase contains water it will drain out.

In cold weather the oil in the cleaner must be carefully watched to see that the oil used is such that it will not congeal to a point where it will not be carried by the air stream to the filtering screens. If the oil congeals it can be thinned down by fuel oil or kerosene to the consistency of milk.

Judging Dairy Cattle

Edwin S. Harrison

Professor of Animal Husbandry, Cornell University

FORM is definitely associated with function among all classes of livestock. The conformation of the running horse is as distinctly different from that of the draft horse as is the purpose. Likewise the body form of dairy animals differs materially from that of beef animals. The recognition of this correlation between form and function has led to the selection of those individuals as they appeared which were best adapted to perform a specific function or purpose. Continuous selection has been the most important contributing factor to the establishment of the various classes and breeds of livestock as we know them today.

Variation Basis of Breed Improvement

Variation among individual animals provides the basis for herd improvement, and without variation there could be no further breed improvement. Both parents contribute to the genetic make-up of the offspring. It will be, therefore, a new and different individual, and not identical with either parent. If both the sire and the dam transmit factors for the same undesirable character, it will be exaggerated in the offspring, with the result that the offspring will be inferior to either or both parents. On the other hand, if both the sire and dam transmit factors to the offspring for a desirable character, the offspring may be superior to either or both parents.

Importance of Selection

Because of the variation that exists among animals, a particular individual is able to perform a specific function more efficiently than another. The successful breeder of livestock selects the superior individuals when they appear, and skillfully blends their blood with that of his herd or flock to produce general improvement of the entire group. Progress in herd improvement, therefore, for a given breeder depends upon his ability to recognize superior quality in livestock, and upon the skill and the wisdom which he exercises in selecting and blending the blood of superior individuals with that of his herd. In other words, variation provides the basis for all herd improvement, and selection offers the method through which herd improvement can be accomplished.

The larger the number of in-

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dependent characters that must be considered, the more difficult is the problem of selection and the more slowly is improvement brought about. In the entire field of animal breeding there is no problem more complex than the problem facing the breeder of dairy cattle, because in no other breed of livestock must selection be based upon as many independent characters. Selection based upon a single character would fail because factors determining milk yield, butterfat test, and many other characters are probably transmitted independently of each other.

Purpose of the Dairy Cow

The dairy cow is kept primarily for the production of milk and butterfat. Therefore, in the selection of dairy cattle, their productive ability must be given first consideration. The importance of all other characters is in proportion to their influence upon the production and the usefulness of the dairy cow. No matter how beautiful a dairy cow may be, she is of little value in a herd or to the breed unless she is capable of producing a profitable yield of milk and butterfat.

Is Type Important?

The importance of type to the commercial dairyman has been frequently questioned. Various measurements of the anatomy of the dairy cow failed to show any significant correlation between any given measurement and production. These studies have been quoted as evidence that type is of little importance to the dairyman primarily interested in the production and sale of milk. There are three reasons, however, why the importance of type cannot be established by any series of measurements of the anatomy of the dairy cow. In the first place there are many characteristics pertaining to dairy type that cannot be measured in feet or inches. Secondly the measurement of external points of the anatomy does not necessarily give accurately internal width or capacity. Thirdly, measurements will obviously be influenced by condition, which is a factor that cannot be completely eliminated.

It is not uncommon to hear the following statement, "She is a good show cow, but a failure at the pail." In most of these cases the cow referred to is straight and smooth, but fleshy and definitely lacking in dairy form. The person responsible for the foregoing statement was simply misinformed concerning the conformation required in a good show cow. No one can deny the fact that in a few cases cows have won high honors in the show ring that have never distinguished themselves at the pail. Frequently these cows are singled out and offered as evidence that there is no correlation between type and production. Such a conclusion is not justified because, in recent years, for every

low-producing cow that has won a leading show there will be found at least a dozen winners with outstanding records of performance.

A few examples will serve to illustrate the point. During the past four years Cornell University has developed and shown three grand-champion cows. One of these cows made a world's production record, and the other two completed records that placed them among the class leaders of their breeds. Two of these three cows have produced offspring that have won championship honors. The grand-champion Guernsey cow at the 1935 National Dairy Show was the highest-record cow in the entire Guernsey show. The type placing on the aged-cow class in this show also lined the cows up in accordance with their production records. The grand-champion and the reserve grand-champion Brown Swiss cows at the 1936 National Dairy Show had both completed records of over 1,000 pounds of butterfat. The sensational All-American Get of Johanna Rag Apple Pabst exhibited by Mount Victoria Farms has an average production of 803 pounds of butterfat. The average production of the Holstein all-American selections for the past four years in the aged-cow, the four-year-old, and the three-year-old classes is 745 pounds of butterfat. This average is based upon actual production, and most of the records represent immature performance.

Observations on the dairy herd at Cornell University very definitely indicate the importance of correct dairy type. Almost without exception the cows with the highest type score are the highest producers in the herd.

Selection Based Upon Type

The experienced breeder or dairyman can divide a group of dairy cows into three lots, high, medium, and low producers on the basis of type with a remarkable degree of accuracy. In other words, the relationship between type and production makes it possible for one trained and experienced in the art of selection to distinguish between high- and low-producing cows by type characteristics. The influence of inheritance and other factors, however, is so great that it is impossible on the basis of type to predict accurately within narrow limits the production of a cow. The fact that the type placing on a ring of cows does not always line them up in accordance with their production records is no reason to conclude that type is not associated with production. It simply means that production is influenced or determined by several factors. For example, the difference in the opportunity provided two cows is frequently much greater than their difference in type.

The illustrations that have been presented show clearly that there is a definite relationship between the conformation of a cow and her production during a single lactation period. The actual importance of correct dairy type, however, cannot be demonstrated unless lifetime performance is considered.

Type Established by Breeding

A cow is a good individual or a poor individual almost entirely because of her breeding. If she is a good individual, it means that she inherited factors for good dairy type from her parents. If she is a poor individual, it means that her sire or her dam, or both, transmitted factors responsible for her defects in conformation. Any animal carrying a serious type defect is likely, in turn, to transmit that defect. When both parents are transmitting factors for a common inherited weakness, it will almost certainly be exaggerated in the offspring. The more exaggerated an undesirable character becomes, the more pronounced is the influence upon production. Therefore, the importance of selecting correct dairy type as a foundation upon which to build a herd cannot be overemphasized.

The number of dairy animals that are satisfactory in every respect is extremely limited. A particular family of females may possess certain highly desirable characteristics and at the same time carry a common undesirable character. Should such a family of females be discarded? The answer to this question is positively no. It is very important, however, that an undesirable inherited character of a particular family be given proper consideration when formulating the breeding program that is to be followed. If a common family weakness is ignored and the females are mated with a male that has inherited and is transmitting factors for the same defect, that defect would certainly become exaggerated in the offspring. Thus, a breeding program that ignores the importance of correct dairy type can, in a relatively few generations, practically ruin any herd. On the other hand, if a common family weakness is recognized and the females are mated with a bull that is particularly strong where they are weak, the conformation defect will be less pronounced in the offspring. Therefore, a constructive breeding program can accomplish much towards eliminating type defects at practically no additional cost.

Observation shows clearly that as a herd loses quality and type, it also loses production. Likewise, as the quality and type of a herd improves, production increases. Because of this positive correlation between type and production, type is of economic importance to every dairyman.

Aside from the economic importance of type, the personal satisfaction derived from working with a herd of cows possessing correct dairy type, compared to a herd of miserable-looking creatures, is sufficient justification for a study of type.

(The above is an excerpt from "Judging Dairy Cattle," by Edwin S. Harrison, printed by John Wiley and Sons, Inc., and for the convenience of the readers may be ordered through the Farmers Digest. $2.75.)

REVIEW OF THE BOOK "JUDGING DAIRY CATTLE"

"Judging Dairy Cattle" by Edwin S. Harrison, Professor of Animal Husbandry at Cornell, is a book which will be of definite interest to all owners of dairy herds. The excellent photographs were taken by Henry A. Strohmeyer, Jr., and John T. Carpenter, Jr. The first few pages are taken up with a discussion of breed improvement in relation to production of milk and the association of type with lifetime performance. There is a full discussion of the true type of cow towards which each of the five breed association is working, and the difficulties involved. The rest of the text describes what the dairy cow of each breed should look like, taking up each part of the body separately, and illustrating each part with photographs of good and bad examples. This book is invaluable to anyone who is trying to improve his herd, as it shows how a herd can be improved without the need of unlimited finances, and how, if these results are achieved, the herd will bring in more money because of better production.

Ecology and Land Use

Condensed from Soil Conservation

Edward H. Graham

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AULUS, the Roman, spoke proudly when he announced that at last they knew malaria was caused by the night air. Then, like other intelligent Romans of his day, he ordered all the doors and windows of his home tightly closed from sundown to sunrise to exclude the "pestilence that walketh by night." Little did the Romans realize that 1,500 years would pass before the truth would be known about malaria—that the disease is carried by the *Anopheles* mosquito. Yet of all the plagues of human history malaria probably has taken the heaviest toll of human lives. For twenty-five hundred years it has persisted throughout many parts of the world. Before the rise of Rome it was recognized as the most deadly enemy of the Athenian Empire, and if she had conquered malaria, Athens would have ruled the world. Ancient Rome lost more soldiers to malaria than to her enemies.

The Roman authorities tried diligently to discover the cause of this plague, and came near the solution, for they found a relationship between the disease and the night air, and closing their homes at night was correct procedure. But the next step in man's knowledge of this malady was delayed 15 centuries until someone began to look for further relationships. Even then, long, patient experiment was necessary to learn the baffling fact that infective transmission requires a certain interval of time, that only a few of more than 100 species of mosquitoes can transmit malaria from one person to another, and that of these it is the female alone which carries the disease.

What we know now about malaria we have learned by attempting to deal with all factors affecting the situation, instead of considering a single factor to the exclusion of others that might have an equally important influence. This is an example of ecological thinking.

Some day we shall look back tolerantly upon the time when bounties were paid for hawks and owls, while men lamented the

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presence of mice and snakes, upon which such predatory birds, if unmolested, effect some measure of control. Shall we not knowingly shake our heads when we recall the widespread efforts of those who so enthusiastically stocked with game habitats unfit to support it, and planted fish in streams and ponds where there was no likelihood of their survival? Game laws not ecologically sound will seem absurd, for the relationship between animals and their environment will be better understood. Even now we know that high populations of deer in the Northeastern States have been possible because food was supplied by second growth browse that sprang up where virgin forests were cut away, and that as this browse matures into forest trees it will no longer be good deer food, and the deer will starve. When that happens the most stringent protective laws will be unable to preserve the animals unless management methods based upon a knowledge of existing relationships are first applied to the land.

In the program of the Soil Conservation Service a fundamental concept is that of a coordinated approach on the part of several technical fields toward the solution of a common problem—soil erosion. This concept is based on the relationship of the land owner to his environment—the farm which he operates and the market which absorbs his production. A sound agricultural program will result in a balanced condition where crops and soil, rainfall and run-off, birds and insects, yield and market, and all other components of the farm as a habitat, are in adjustment. In this light, prevention of soil erosion on agricultural land, like every conservation endeavor, is fundamentally an ecological problem.

That farming involves many ecological patterns is illustrated in the following example: For a long time agriculturists advised against the use of a permanent ground cover of herbaceous vegetation in southern California pear, avocado, and citrus orchards. It was believed that a ground cover of vegetation sheltered field mice and other rodents which ate the bark and roots of trees, provided protection to injurious scale insects, increased irrigation costs by absorbing water, and, through competition for nutrients, reduced fruit yields. However, orchards maintained for a great many years in permanent cover of herbaceous perennial legumes and grasses have demonstrated that yields are not reduced under this practice. On the contrary, packing house records show yields from these orchards to be much higher than the average; they also bring better than average prices. Furthermore, operation and irrigation costs are low. Ir-

rigation is accomplished by flooding from furrows constructed across the slope, the water being spread by the dense plant cover which, by providing infiltration into the soil in place of rapid runoff, actually conserves water.

Flood irrigation in itself is an effective aid in controlling gophers and other small rodents, and the cover of herbaceous vegetation supplies food for mice that no longer are forced to feed on the trees. The ground cover harbors predaceous insects and ground nesting birds that help naturally to combat insect pests. Permanent cover likewise obviates annual seeding, practically eliminates cultivation costs, prevents interference with feeder roots of the trees located near the surface of the ground, and prevents soil erosion. Thus the invaluable soil resource is permanently protected, and harmonious relationships are established among the biological components of the orchard community which it is to man's advantage to understand and maintain.

In farm woodlands man profits by knowing something of ecology. The snowshoe hare of our Lake States forests is often blindly charged with intolerable injury to young trees. This is especially true on clean-cut or burned-over areas where natural reproduction results in very thick stands. Now the hare is a highly cyclic species, with "highs" of large populations occurring at 10-year intervals. When the hare population is at its peak the animals eat, girdle, or prune the young trees until the stand is so open that they may be easily seen by predatory mammals, owls, and hawks. The hares must then retreat to thicker stands for protection. They may return at intervals of a few years whenever the trees have again thickened enough to form protective cover, and may thin out the stand recurrently until the bark becomes too thick to be palatable. Instead of being an unmitigated evil, however, the opening of the stand in each case permits the remaining trees to recover from their stunted condition, helps to reduce the fire hazard, and minimizes insect damage.

In northern Minnesota the value of the thinning operations of the snowshoe hare is set at a high figure. Furthermore, foresters have learned that in this region plantations of trees show a much higher percentage of survival if the plantings are thin, in which case they do not provide escape cover under which the snowshoe hares can work, and that there is minimum damage if plantings are correlated with "lows," in the population cycle of the hare.

Small forest animals, such as shrews, moles, mice, and chipmunks, have long been listed on the debit side of the forester's ledger, because they eat seeds

and damage tree seedlings. Yet, recent studies show that small animals inhabiting the forest floor eat an astonishing number of insects, many of them larval forms of species highly destructive to mature trees. The insect-destroying values of these mammals may be even higher than the values of insectivorous birds, for the number of such animals per acre is greater than the number of birds, and, unlike most birds, the mammals are resident and usually active throughout the year. It is conceivable that, without forest animals, we might have no forest at all.

The older forest plantations of continental Europe, planted to pure stands of spruce or pine, once were lauded for the neat appearance of row after row of similar trees. Today we know that soils are depleted under a uniform type of forest cover, and that disease is prevalent because it can spread more easily than in mixed stands. In such European forests insect damage is so widespread that birds boxes are being installed in an attempt to restore artificially some semblance of the biological balance which was lost by man's failure to think ecologically.

To the ecologist there is real significance in the adage that man must learn to work with nature, not against her. But the ways of nature are not easy to learn. The following example illustrates this: If a coyote is observed to kill a lamb a fact is established, namely, that coyotes kill lambs. Since lambs are desirable, the obvious conclusion seems to be that coyotes must be destroyed if lambs are to survive. This is the simplest deduction—but it does not represent ecological thinking. The ecologist wants to know how the destruction of coyotes affects other things. Unfortunately, much more money and effort have been spent in destroying coyotes than in attempting to learn the place they occupy in the biological complex of which they are a part. Nevertheless, we have learned enough about their food habits to know that they live on rabbits and various small rodents to a substantially greater extent than on lambs.

Of rabbits and rodents that live throughout the range of the coyote another isolated fact is apparent— rabbits and rodents eat grass. This simple relationship seems also to interfere with an activity of man, for cattle and sheep likewise eat grass. The obvious conclusion is that rabbits and rodents should be destroyed to preserve food for livestock.

But it is apparent that the destruction of coyotes and the simultaneous destruction of rodents, on which coyotes naturally prey, is illogical. For if man did not reduce the number of rodents by poisoning, the coyotes, finding their natural food more abun-

dant, might feed more upon rodents, and less upon lambs. There would then be less need to kill coyotes. Also the rodents thus naturally reduced in numbers, would compete less with livestock for food; man could put to better profit money he now spends in rodent and predator control.

Of course, practical management of wild animals in relation to range land is not as simple as the writing of the preceding paragraph, but a consideration of the interrelationships stated is a simple example of ecological thinking. From this knowledge the ecologist wants to go forward—to learn more about other relationships between coyotes, rodents, man's domesticated animals, and the vegetation of the range, until he discovers what factors, if any, must be modified to attain the biological balance that will provide the maximum return from the land consistent with its best use and long-time productivity. It may well be that regulation of livestock grazing to the carrying capacity of the range may prove to be the management measure that will keep both rodents and their predators under control. Proper grazing is a way of working with nature and may upset the desired balance less than any other kind of disturbance man might introduce. Ecologists might profitably be employed to learn more about these relationships.

Today we hear more and more about ecology. We hear that conservation of resources is attainable only if founded upon ecological principles; that many subjects, such as geography, are properly taught only when treated as human ecology; and that the tumultuous unrest of the world today exists because man has held more to political than ecological tenets. Such ideas are based on the conventional definition of ecology—the science of the relation of living things to their environment. The concept of ecology as a science, however, connotes a language of unfamiliar technical terms and a knowledge available only to the specialist. But in a broad sense, ecology is much more a process of thought than a science, and as such is useful to a great many persons. To think ecologically requires only a knowledge of facts and an ability to relate them correctly. Anyone can utilize this type of reasoning, although to arrive at a solution in specialized fields a trained ecologist may be required to interpret accurately the facts and place them in their proper relation to each other.

The ecologist finds practical as well as theoretical usefulness in the concept called succession. This concept contends that primeval vegetation undisturbed by man, whether it be forest, grassland, or desert, is in essential equilibrium with the climate.

Such vegetation is considered climax for the region and will perpetuate itself. If the climax vegetation is removed from an area, it is not reestablished until several different plant communities have successively occupied the area, each more like the climax type than the preceding. For instance, if a virgin hemlock-hardwood forest is destroyed by lumbering, it is not a stand of young hemlock and hardwoods that immediately begins to replace the cut-off trees. Instead there first springs up a growth of annuals, usually widespread weeds. A few years later this is succeeded by a cover of herbaceous perennials. Still later shrubs invade the area and finally, after many years, trees such as cherry, aspen, and birch appear. In the course of a long time, these trees are gradually replaced by climax species of hemlock and hardwood, to produce eventually the type of forest originally on the land. Of course, many kinds of disturbance, as fire, cultivation, and erosion, may modify this succession, and man's activity ever tends to prevent its progress; but it is an ecological law that the vegetation of a disturbed area attempts incessantly to return to its original climax composition that is in equilibrium with the climate of the area.

Anyone familiar with the stages through which a given succession must progress in reproducing the climax type, can tell from the plant cover of a disturbed area how far it has developed toward duplication of the original vegetation. Likewise, if he watches an area over a period of years, he can determine whether it is progressing toward the climax or retrogressing toward a lower stage in succession, as it does under misuse and erosion. Man is only beginning to learn how to apply this principle to his daily activities, although a generation ago ecologists learned that in the wheatgrass grazing land of central Utah the species of plants increasing on the range tell one of two stories. If plants appearing on the range belong to a stage lower in succession than the predominant vegetation, the range is deteriorating, a condition brought about by misuse, as overgrazing; if invading plants belong to a higher successional stage, then the range is improving.

No amount of money spent on weed control when the range is in the annual weed stage, or even in the perennial weed stage, can successfully eliminate weeds. The only economic way to control weeds is to remove the cause of their appearance, in this case overgrazing. When grazing pressure is relieved, the natural process of plant succession will inevitably replace the weeds with more desirable plant species—and at no cost to man.

More recent studies of the

vegetation of abandoned fields in Western Nebraska indicate that it is possible to determine, from the plants growing there, exactly how many years ago a particular field was last cultivated. Consequently, an ecological knowledge of plant communities and succession makes it possible not only to understand something of the past history of a parcel of land, but to predict its future as well, which, in the last analysis, is one of the greatest tests of the usefulness of any human discipline.

That man, by proper management, can maintain native vegetation in a condition suitable to his needs, that he can "arrest" succession, is a comparatively new thought. It would seem to be valuable in range and pasture management, forestry, and nearly every agricultural practice dealing with plants except the cultivation of annual crops.

In any program aimed at the proper use of land, ecological thinking is a prerequisite. Interrelationships of plants, animals, and man with the physical environment, the trend of plant succession and how to make use of it, and attention to many minor axioms of ecology must be considered, else man pushes a wagon with the brakes on. The attempt of the Soil Conservation Service to apply use-capabilities to types of land is of interest in this regard. This scheme recognizes a relationship between several factors such as soil type, degree of slope, vegetative cover, erosion, and the best adapted land use. To maintain some semblance of balance between use and conservation of land, it is generally true that disturbance of the soil must decrease as the slope of the land increases. Therefore, on the steepest and most erodible slopes a protected permanent cover of vegetation, as forest or prairie sod, must be preserved. On slopes less easily disturbed, carefully managed pasture may prove a wise land use. Still gentler slopes may be cultivated with careful application of soil-conserving practices, including, perhaps, long periods in grass rotation, while constant disturbance may be safe on the most level and least erodible areas. The designation of specific land-use capabilities for various types of land according to a consideration of all their physical properties represents a concrete application of ecological thinking.

Another matter in which the ecologist is interested is what happens when non-native plants or animals are introduced into a region. In older countries, such as England, some sort of biological balance has been attained, but in newer countries the consequences of introductions are not easily predicted and may present extremely complicated biological interactions. For example, some zealous gardener, who wanted to make Hawaii even more beauti-

ful than it was, introduced there an ornamental tropical American shrub, *Lantana camara*. In its home this plant "knows its place" but, as we shall see, in Hawaii it took full advantage of its new association.

Some time before the introduction of this shrub, turtle doves from China had been brought to Hawaii, and Indian mynah birds also were introduced. Unlike natives, these two birds fed heavily upon Lantana fruits. The aggressiveness the plant displayed in its new habitat plus the capacity of the exotic birds to distribute the seeds combined to make the plant a serious pest in parts of the islands devoted to grazing. But there is even more to the story. Before the mynahs were introduced, the Hawaiian grasslands and young sugarcane plantations had been severely damaged by armyworm caterpillars. When the mynahs came, however, they helped to keep the armyworms under control. Meanwhile someone got the idea that certain foreign insects would check the spread of Lantana by eating the seeds. Consequently, insects were introduced. As predicted, they destroyed so much seed that the Lantana began to decrease. Then the mynahs, deprived of Lantana seeds for food, likewise began to decrease. This resulted in a recurrence of armyworm outbreaks. Furthermore, many of the places now vacated by the Lantana shrub became occupied by other introduced shrubs, even more difficult to eradicate than Lantana. Here is a lesson about the reckless introduction of exotics, for the result in this instance was an ecologically unbalanced situation becoming for man a long difficult task in bringing about some sort of desirable stabilization.

In the United States much damage has been caused by exotics, such as the chestnut blight, Hessian fly, cotton boll weevil, and weeds, most of which are Eurasian plants. Of course, native species may also cause trouble, as do the grasshoppers of the Great Plains. In defense of introductions, one might argue that many of the cultivated crops of the United States and nearly all of our domesticated animals are non-native species. For the most part they survive, however, only when tended carefully by man. This discussion is not intended as a statement to the effect that introductions are necessarily harmful, but rather to emphasize the fact that great care must be exercised in tampering with the ecology of an area, and that it is imperative for his well-being that man think ecologically as well as in terms of simple cause and effect relationships.

We live in an environment of many facets related not as single pieces, but as a mosaic, the pattern of which is not appreciated at first glance but must be seen in

different lights to disclose its true design and its real worth. Thus it is easy for man to look to immediate gain, forgetful of the long-time advantage. But to achieve a lasting economy he must consider all the implications of his operations on the land. Might it not have been possible to prevent the passage of homestead laws that once encouraged families to live on land incapable of supporting them? Might the Great Plains have been spared the devastation that resulted from wholesale plowing of the sod with no regard for consequences? Could drainage that exposed land worth less than the cost of drainage operations, and many other activities we now regret, have been avoided? Is what we plan today equally unwise, or are we prepared to consider all the interrelationships our actions might involve, and act upon that knowledge? It is not an easy responsibility. Ecological thinking is one discipline to aid man in dealing with the world in which he lives, and one to which, in the future, he must be forced more and more to give attention.

Cooperative Egg Marketing

Condensed from American Poultry Journal

L. M. Hurd

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ABOUT ten years ago, the fact was impressed upon the writer, after visiting many poultry farms in various parts of New York State, that the producer was not satisfied with the price he was receiving for eggs sold on the New York market. There seemed to be a feeling among producers that receivers in New York were not giving them the price for their eggs they should, considering the quality of the eggs they shipped.

Similarly, when visiting receivers in the New York market, it was noticed that dealers complained about the quality of eggs received from poultrymen who were supposed to be producing top quality eggs. Out of this situation, the poultry specialists at Cornell developed a plan of visiting farms of producers to check on the conditions under which their eggs were produced, and then visiting the receivers' stores in New York City to check on the quality of the eggs as they arrived. The service thus developed was dual, in that it helped the producer to find the things that might be affecting the quality of his product and it checked the quality of the eggs as they arrived in the receiver's store, giving the dealer an opportunity to point out defects in the eggs which might affect the price. In the period of a few years, the handling of eggs was checked on hundreds of farms, and many dealers were visited.

The large volume of inspection work resulted in the development of a form known in New York State as the Farm Market Score Card. In reality, the Farm Market Score Card is a systematic method of checking all factors that may affect the quality of eggs after they are laid. This card is divided into 5 parts. The first section deals with the place where eggs are stored before shipping, the second covers methods of gathering eggs, the third checks the arrangement of nests in the laying house and sanitary conditions, the fourth deals with method of packing and shipping the product, and the last section checks methods of feeding.

A place is provided on the score card for a candling report and the per cent of eggs of differ-

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FARM MARKET SCORE CARD

Total Points	Conditions	Perfect Score	This Farm	Remarks
Egg Holding Room	Location			
	Temperature	15		
	Moisture	5		
	Cleanliness, odors	3		
25 Points	Ventilation	2		
Egg Handling Practices	Daily gatherings	9		
	Promptness to egg room	2		
	Grading	6		
	Egg containing containers	1		
20 Points	Time cooled before packing	2		
Nest and House Conditions	Nesting space	4		
	Condition nest material	5		
	Nest arrangement	4		
	Dropping boards	2		
	Litter	5		
25 Points	Per cent eggs dirty	5		
Egg Packing	Cases, flats, fillers	5		
	Care in packing	2		
15 Points	No. shipments weekly	8		
Flock Management	Green food	5		
	Cod liver oil	5		
15 Points	Oyster shell	5		
100	Total score	100		

ent grades. The percentages of very dirty, slightly dirty, and clean eggs are recorded in another place. It is customary to inspect 50 or 100 eggs on each farm. The candling report is made on eggs about 24 hours old, while the count of dirty eggs is made as the eggs are gathered, or before any are cleaned. A sling psychrometer is used to find the temperatue and relative humidity in the egg room.

As a result of this work with producers and dealers, poultry keepers throughout the state have been greatly educated in the best methods of building up and maintaining quality in eggs shipped to market. Producers have not always been successful, however, in securing a price corresponding with the improvement of quality. The problem of the average producer today is to secure what his eggs are worth. Some producers, due to their business ability, initiative, and size of their business, are able to get special concessions in the way of premiums for their eggs sold to New York City dealers. Other producers, due perhaps to poor salesmanship or because of small-

er flocks, but with the quality just as good, are not able to secure as good prices.

What can be done about such a situation? Two or three years ago, it was suggested to two county agents, who were very much interested in this marketing problem, that possibly a solution might be reached by organizing a small group of interested producers in a county and pooling the sale of their eggs through a marketing committee. In reality, the marketing committee would be a bargaining committee, to sell the eggs of all members at a uniform price in much the same way that a labor union negotiates for a uniform wage. Meetings of producers were arranged, the idea explained, and a vote taken, with the result that the county plan of marketing eggs was launched.

The County Plan

At the suggestion of the poultry specialists, the county marketing groups agreed on certain rules for the maintenance of quality as follows:

1. Produce clean infertile eggs.
2. Gather eggs 3 times daily and hold them in a clean, ventilated, cool place (40°-60° F.). Precool eggs in wire baskets or on wire trays before packing.
3. Grade all eggs carefully as to size and color and pack each grade separately in strong, clean cases, with sound, clean flats and fillers. The following grades for size are used:

Wt. Per Doz.	Ave. Gross Wt. Per Case
Large, 24 to 27 oz.	60 lbs.
Medium, 20½ to 24 oz.	54 lbs.
Pullet, 18 to 20½ oz.	49 lbs.
Peewees, 16 to 18 oz.	44 lbs.

4. Ship or dispose of all eggs not less than twice weekly.
5. Supply all birds with clean wholesome feed carrying the maximum amount of vitamins and minerals.
6. Keep the buildings and land in a reasonably sanitary condition.

Each member agreed to have his farm inspected twice a year, either by a specialist from the Poultry Department at Cornell, or by the county agent. The Farm Market Score Card, described above, was used for this inspection. In bargaining for the sale of eggs, the marketing committee showed to all prospective purchasers the rules which they proposed to use to maintain quality. When a dealer was found who was willing to pay the price, with added premiums, which the producers felt was satisfactory, a contract was drawn up in which the producers agreed to supply the receiver with eggs meeting the market standards agreed upon. A label signifying the county and the organization of the producers was designed.

Before a member of the group could qualify to ship eggs to the

designated dealer, he was required to have a farm score of at least 75, and 95% of the inspected eggs must meet the standard for Grade A, or better when candled. After the member qualified as a shipper, it was agreed that his eggs must arrive at the market in a condition satisfactory to the dealer for a period of a month before the special county label could be used. If, for any reason, the eggs fell below the usual quality upon arrival at the market, the dealer was required to remove the labels from the cases and notify the county agent of the situation.

It was then the duty of the county agent, in co-operation with the poultry specialist from the College, to check the producer's farm to find, if possible, the cause of the drop in quality. If a solution was not arrived at and eggs continued to arrive in the market below standard, the member usually dropped out of the group or took less for his eggs. He could not use the county label. Each member agreed to ship all his eggs to the designated buyer. Exceptions, however, were made subject to the approval of the marketing committee. Any member can withdraw from the group by giving a month's notice.

Each member ships his eggs directly to the dealer designated by the marketing committee. All checks are mailed directly to the producer by the dealer; consequently, overhead costs of such a group are small. Labels cost a cent a case. A small yearly membership fee pays the cost of postage and other incidentals. The county agent and poultry specialists act as advisors.

It is surprising how much these clubs, or marketing agencies, have done in counties where they have been organized to interest poultry keepers in better quality eggs. Not only have those participating in the sale of their eggs through these clubs been directly benefited in dollars and cents by the organized sale of their products, but producers outside of the organization have been helped as well, and undoubtedly have been influenced by the work of the club. The county label has been good advertising for the county. The producers have a greater sense of pride in the product of their county.

The county plan of selling eggs is not perfect. It does not offer the opportunity for volume, which is one of the most important points in the co-operative sale of any product. It does, however, offer the opportunity to stimulate pride in a county brand and in the sale of eggs from a locality, and it may offer an opportunity of federating groups into a statewide organization for the co-operative sale of eggs in the future.

Dairy Sanitation

Condensed from The Jersey Bulletin

S. G. Connelly, S. W. Dickson

Virginia Polytechnic Institute

CLEANLINESS is a fundamental principle of sound dairying. Without proper sanitation an entire farm dairy operation may be endangered. The health of the herd, the quality of the milk, and the wellbeing of everyone dependent upon the industry may be affected by any indifference to cleanliness in the dairy barn, milk house or milk plant.

There are many phases of this problem; only one—disinfection—can be considered here. Disinfection is understood to mean the killing of disease producing bacteria or germs. In no case, however, is disinfection a dependable substitute for careful cleansing. Careful cleaning should precede the application of any disinfectants.

Experience has demonstrated that there is no one best disinfectant. Those that are effective against one type of germ under certain conditions may be worthless against other types under other conditions. In other words, when using a disinfectant around the dairy, one should study the conditions under which it is to be used, as well as the kind of germ it is supposed to kill.

The first step in disinfecting a building is to remove the source of the germs. This will mean the removal of any animals that may be giving off germs, such as sick animals, and the thorough cleaning of the building or premises with which the infected animals come in contact. If the source of contamination is first removed, and the building, fixtures, are carefully cleansed, then appropriate disinfectants can be more effectively used.

It is well known that animals kept in contact with manure and filth are less apt to escape disease, Hence, manure and other waste materials should be removed from the barn as a matter of daily routine. If this waste material can be applied on the land and then plowed under, the action of the sunlight and other agencies in the soil will destroy most germs. Then, as a matter of disease prevention, the walls, ceiling, floor, fixtures and other parts of the dairy building and lots should be thoroughly washed and scraped several times each year

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to remove all dust and other organic material. Disfectant should then be applied.

When selecting a disinfectant, get one that fits the local conditions and that is effective against particular germs. In this connection the most expensive disinfectant might not be the best. Definite veterinary advice might serve well when disinfectants are selected. Around the dairy, of course, one should give preference to those disinfectants that are not poisonous; or do not leave any odor to taint the milk. Ordinarily the measure of strength of a disinfectant is its phenol coefficient, or its strength as compared to phenol or carbolic acid. It would be well to keep this point in mind when selecting a disinfectant.

Since disinfectants must come in direct contact with the germ in order to be effective, it is best in most cases to use liquid disinfectants, and apply them with a force or pressure pump. If the surface can be scrubbed with a broom, the disinfectant becomes still more effective. Unless the germs are soaked in the disinfectant enough to kill them, one may live under a false sense of security. Hence, too little disinfectant may be worse than none at all.

Direct sunlight is a good disinfectant against all germs that do not form spores. But sunlight cannot penetrate filth and dirt, and its effectiveness is greatly decreased if the sunlight filters through ordinary window glass. Therefore, the buildings that are cleaned thoroughly and exposed to the direct rays of the sun are likely to receive much natural disinfection.

Heat, either dry or moist, if intense enough, or applied long enough, is an effective disinfectant. In disinfecting the stables and yards, however, the flames from blow torches have not been particularly successful, since cold concrete and similar materials do not permit the proper penetration of heat. On the other hand, moist heat such as live steam or boiling water, is much more efficient than dry heat, particularly when the object to be disinfected can be immersed in the hot water or steam until thoroughly heated.

Chemical disinfectants are most commonly used to disinfect dairy barns and yards. Among the mineral salts, bichloride of mercury is a good disinfectant in a solution of 1:1000. It is effective against germ spores when applied hot. Bichloride of mercury, however, becomes worthless when mixed with urine, manure or other organic matter. It corrodes metals, and is very poisonous to animals and man; therefore cannot be safely used on the farm.

Zinc chloride is far inferior to mercury salts as a disinfectant.

Copper sulphate (blue stone) in dilutions of 1:1,000,000 will

kill algae or mosses that grow in reservoirs and is quite effective against snails and certain animal parasites. As a general disinfectant, copper sulphate has very definite limitations.

Among the coal-tar group of disinfectants, phenol (carbolic acid) is fairly reliable against most bacteria, but not against spores. Crude carbolic acid is more effective than pure phenol. Ordinarily the effectiveness of phenol is not seriously affected when mixed with organic matter, and does not lose strength with age. Usually it is used in a five per cent liquid solution, but even this weak solution is quite poisonous to animals and man.

The cresols, such as lysol and creolin, and other commercial preparations of the cresols, are effective against germs even in the presence of organic matter. The cresols are usually two to four times stronger than phenol, and are used generally in a two per cent water solution. They are standard disinfectants, but do not mix well with hard water and do create an unpleasant odor that is readily absorbed by milk. For best results, cresols should be used hot.

Chlorine in the form of hypochlorites in several commercial forms have proved quite valuable as general dairy disinfectants. The free chlorine is effective against all types of disease germs, except those of the tuberculosis group. Hypochlorites can be used in rinse water for milk pails, cans, milking machines, etc.

Among the alkali disinfectants lye (sodium hydroxide) is one of the most economical disinfectants one can use on the farm. One part of lye in 150 parts of water (one can of high test lye in 15 gallons of water) is very effective against abortion and certain other germs. Lye is regarded as one of the very best disinfectants for scrubbing barns and milk houses to destroy germs and disagreeable odors from souring milk. Lye does not kill tuberculosis germs, but it does destroy many germs associated with animal discharges. Hot water is excellent for scrubbing or washing out cow stables.

Whitewash made freshly from quick lime is an efficient germicide. If the surfaces are clean and a little lye is added to the whitewash, its effectiveness is greatly increased.

In all cleaning operations, however, one should not use wire brushes, since particles of wire might get into the cow feed and cause the loss of a cow.

Fumigation is not a practical method of disinfection, and disinfectants that kill one type of germ may not kill others. In no case, however, is disinfection a curative for contagious diseases, such as tuberculosis, Bang's disease, etc., when infected animals continue in the herd.

Proving Beef Sires

Condensed from California Cultivator

A simple method of "proving" beef sires similar to the plan now used in "proving dairy sires has been developed by beef cattle specialists of the United States Department of Agriculture. By this method young bulls may be proved by their first calves and their value as sires determined.

The two plans are alike in that the worth of the sire in both cases depends on his progeny's record-of-performance. The beef sire is judged on his ability to transmit a capacity for efficient gains and high-quality meat just as the dairy sire is rated on his ability to transmit the capacity for high milk and butterfat production.

Beef-cattle breeders still depend largely on pedigrees and breed type in selecting herd sires, although differences in the ability of sires to transmit efficiency of gain and carcass quality to their progeny have long been recognized. Many sires of good type do not produce calves that gain efficiently.

Proving of beef sires has required study and evaluation of many factors affecting the calf from the time of birth until it is slaughtered, say W. H. Black and Bradford Knapp, animal husbandmen who conducted the studies. They have studied sire performance for eight years with four breeds at three experiment stations.

The first essential in proving the beef sire is an equal opportunity for all of his calves on test—there should be a minimum of five steer calves. Because the dam of one calf may give more milk than another, the test is begun shortly after weaning time and the calves weaned at the same weight regardless of age. In the department's tests all calves were started on the test at 500 pounds and slaughtered at 900 pounds. Neither the time spent in gaining the 400 pounds, nor the age of the calf when the test began are considered.

In the department experiments each calf was fed in individual self-feeders so that an accurate check on the amount of feed consumed could be kept. Each was allowed to eat all it wanted so as to make full use of its ability to produce effcient gains and high-quality meat.

In the prosposed method of proving beef sires the fattening ration may vary from region to region, using the most practical and available feed. Corn, barley, wheat or grain sorghums may make up the bulk of the record-

of-performance ration, with a dry legume roughage that is more or less uniform in quality from year to year. At the Agricultural Research Center, Beltsville, Md., the ration consisted of two parts of cracked corn to one part alfalfa hay.

In developing the method, twenty body measurements were made of each calf as they went on feed and again just before slaughter, but it was found that weight and height of the animal at the withers give a good correlation of all the measurements. From these two measurements, the grade of the steer may be determined. Using this method of evaluation, it is pointed out, a record of the worth of all beef sires would be available if kept by a central agency.

How the record-of-performance tests may eliminate some sires with blue ribbon ancestry was shown at one of the Bureau of Animal Industry's stations. Here, calves from two bulls of prize winning ancestry were placed on a corn and alfalfa ration—the corn valued at 60 cents a bushel and the alfalfa hay at $20 a ton. The cost of the 400 pounds gain for calves of one sire was $31.66 per calf less than for the other sire.

Milk Vending Machines

Condensed from New England Homestead

Robert C. Jackson

DROP a coin into a slot and get a cool bottle of milk! It won't be long before that will be a common practice throughout the United States if results of a survey of milk vending machines now in operation in Massachusetts are any criterion states the Massachusetts Milk Control Board.

"From information gathered in the survey, vending machines appear to offer a valuable new outlet to increase Class I milk sales, a vital factor confronting the industry as a result of increased production in the United States," said Secretary Reuben O. Robie, of the Massachusetts Board.

"The great increase made in the number of machines in use within the last few months is evidence that they are proving a decided attraction to milk consumers," added Mr. Robie.

Of the nine dealers contacted by the Board, only one stated that he had stopped using ma-

chines. That dealer, however, asserted that he felt that vending machines had a definite place in the industry and added that he would again use them when certain improvements have been made.

Various types of dispensing machines are being used, the survey revealed, with capacities ranging from 75 to 240 halfpint units. The prevailing size of machine handles from 75 to 100 units.

It was pointed out by every dealer reporting that factories have proved to be the best selling locations. Here they found that persons who have been taking milk with their lunch now purchase the chilled milk from the machines, while others who in the past have been in the habit of purchasing tonic either at lunch time or during working hours have now turned to milk. While the dealers are unanimous that the dispensing machines furnish a valuable outlet for fluid milk sales, they do feel, however, that some improvements should be made in the operation of the machines.

Records kept by dairies on monthly sales through these machines show a natural marked increase during the summer months. Regardless of the period of the year, several of the dairies said that they are often called to service machines more than once a day. Flavored milk sales top those of plain milk with chocolate milk leader.

"What pleased us most in the survey was the whole-hearted backing given these milk dispensing machines by various superintendents and presidents of plants in which they have been installed," commented Mr. Robie, "In making the survey we asked each dealer the location of the machines and if he would be willing to have us contact someone at the plant to ask him what their reaction had been.

"These industry leaders have made several interesting comments upon the availability of milk for their workers as furnished by these machines. They are unanimous in the belief that these machines have improved employee-employer relationships; that the milk obtained from them has furnished a much needed pick-up in plants where work is confining and that other results have been improved morale and health of employees."

In many instances these machines are placed in the factories by the dealers with the profits accruing from them going to the employees benefit association. This fact alone is believed to give employees an added stimulus in their purchases.

Further studies on milk vending machines are being made by the Board.

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

Beef Cattle—By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Son, Inc. $4.00.
(See Farmers Digest, November, 1939)

Beekeeping—By Everett Franklin Phillips, Professor of Apiculture, Cornell University. Published by the Macmillan Co. $4.00.
(See Farmers Digest, July, 1940)

Breeding Your Own, or Raising Colts for Pleasure and Profit — By Clarence E. Bosworth. The Derrydale Press ($10.00). A book suitable for the breeders of hunters' and saddle horses.

Conservation in the United States—By Gustafson, Ries, Guise and Hamilton. Comstock Pub. Co. $3.00.
(See Farmers Digest, July, 1940

Dairy Cattle and Milk Production—By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. Macmillan Company. $3.60.
(See Farmers Digest, February, 1940)

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.
(See Farmers Digest, October, 1939)

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. Macmillan Co. $2.90.
(See Farmers Digest, January, 1940)

Farm Records—By John A. Hopkins, Ph.D., Asso. Prof. of Eco., Iowa State Col.; pub. by Collegiate Press. $2.50.
(See Farmers Digest, October, 1940)

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $2.75.
(See Farmers Digest, January, 1941)

Livestock and Poultry Diseases—By W. A. Billings, Asst. Prof. of Vet. Medicine, Univ. of Minnesota. Macmillan Co. $3.50.
(See Farmers Digest, June, 1940)

Poultry Husbandry—By Morley A. Jull, Prof. of Poultry Husbandry, Univ. of Maryland. McGraw, Hill & Co. $4.00.
(See Farmers Digest, July, 1939)

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. Macmillan Co. $3.75.
(See Farmers Digest, September, 1939)

Poisonous Plants of the United States — By Walter Conrad Muenscher, Prof. Botany, Cornell. Macmillan Company. $3.50.
(See Farmers Digest, November, 1940)

Sheep Production— By Levi Jackson Horlacher, B.S.A., M.A., Asst.to Dean, Col. Ag. Univ. Ky. McGraw-Hill Co. $4.00.
(See Farmers Digest, September, 1940)

Soil Conservation—By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Department of Agriculture. McGraw-Hill Book Company, Inc. $6.00.
(See Farmers Digest, December, 1940)

Vegetable Crops—By Homer C. Thompson, Ph.D., Prof. Veg. Crops, Cornell Univ. Pub. McGraw Hill Book Co. $5.00.
(See Farmers Digest, May, 1940)

For the convenience of our readers, books listed may be purchased through this Department. Address C. Leavitt Dyer, Farmers Digest, Ambler, Pa.

INDEX

Beef Cattle

Effect of Age Upon Gain ..... May, 1940
Production Records Point the Way ..... May, 1940
Corn Improvement Marches On ..... June, 1940
Bran Beats Cottonseed Meal ..... July, 1940
Beef-Making Equipment ..... Aug., 1940
Good and Poor Doers ..... Aug., 1940
Ghost Meat ..... Sept., 1940
Feeding Citrus Waste ..... Oct., 1940
Next Things in Breeding ..... Oct., 1940
Ranching is a Big Business ..... Nov., 1940
Feeding the Beef Herd ..... Dec., 1940
Cream Beef ..... Dec., 1940
Buying Meat by Grade ..... Dec., 1940

Conservation

White Top, Enemy Numbe. One ... Nov., 1939
Nebraska's Program for Weed Control, Dec., 1939
Grass to Soil or Soil to Grass ..... Jan., 1940
A Hundred Dead Cities ..... March, 1940
Holland Builds a Masterpiece ..... April, 1940
Co-operative Farm Forestry ..... May, 1940
Soil Erosion Threatens our Vineyards, May, 1940
Control of Soil Erosion ..... July, 1940
Economics of Soil Conservation .... Aug., 1940
Use of Fertilizers in Soil Conservation, Nov., 1940
Rye Grass as a Soil Builder ..... Nov., 1940
The Conservation Problem ..... Dec., 1940

Crops

Depth of Moisture and Yield of Wheat, May, 1939
Chemistry Weeds the Oats ..... June, 1939
Prussic Acid in Sorghum ..... June, 1939
Birdsfoot Trefoil ..... July, 1939
Grass Farming System ..... July, 1939
Curing Hay in the Barn ..... July, 1939
Doubles Protein Yield ..... Aug., 1939
Green Manures ..... Aug., 1939
Seed Harvest ..... Aug., 1939
Raising Ladino Clover ..... Aug., 1939
Hairy Vetch in Corn ..... Aug., 1939
Air-Conditioned Hay ..... Aug., 1939
How to Harvest Flax ..... Aug., 1939
Enriching Timothy with Nitrogen .. Sept., 1939
Cover Crops Increase Yields ..... Oct., 1939
It Pays to Fallow for Alfalfa ..... Oct., 1939
Domestic Rye Grass ..... Nov., 1939
Late Grazing Winterkills ..... Nov., 1939
Fertilizing the Wheat Crop ..... Nov., 1939
Smooth Brome Grass ..... Dec., 1939
Florida's Sugar Bowl ..... Dec., 1939
Ground Sprays for Apple Scab ... March, 1940
Cranberries, $5,000,000 Industry . March, 1940
Winter Injury ..... March, 1940
New Strain of Clover ..... April, 1940
Sprays for Annual Weeds ..... May, 1940
They Test New Wheats ..... July, 1940
Strawberry Clover ..... July, 1940
Ladino Clover ..... Aug., 1940
Establishing Alfalfa ..... Aug., 1940
Salt Marsh Hay ..... Sept., 1940
Sweet Clover ..... Oct., 1940
A Trick on Winter Wheat ..... Oct., 1940
Weed Control in Tobacco Plant Beds . Oct., 1940
Legumes ..... Oct., 1940
Legumes Build Soils ..... Dec., 1940

Dairy Cattle

Sanitary Care of Milking Machines ... Nov.,
Development of Dairy Heifers ..... Dec.,
Feeding Grass Silage to Dairy Cows ... Jan.,
Calfhood Vaccination ..... Jan.,
Official vs. Ordinary Milk Records ... Feb.,
Lessons in Breeding ..... Feb.,
Producing Clean Milk ..... Feb.,
Calfhood Vaccination for Bang Abortion ... March,
Increasing Milk Production ..... March,
Revolution in a Test Tube ..... April,
Blood-plate for Mastitis ..... April,
American Dairy Cattle Club ..... April,
Thiamin in Milk ..... April,
New Uses for Milk ..... May,
A Report on Artificial Breeding ... May,
Feeding the Herd ..... May,
Raising Calves on Wire Floors ... June,
Water Heaters for the Small Dairy ... July,
Mastitis Control Program ..... July,
Milk by the Jugful ..... July,
Feeding Milk to Calves ..... Aug.,
Roughage Rations for Dairy Cows ... Aug.,
We Milk Cows Before They Freshen, Aug.,
Tanbark Etiquette ..... Sept.,
Are You Feeding Vitamin A? ..... Oct.,
Acetonemia ..... Oct.,
Invigorating Bulls ..... Nov.,
The Dairy Cow Can Take It ..... Dec.,
Artificial Breeding ..... Dec.,

Farm Machinery

The Combine Harvester ..... Jan.,
Short Cut in Liming ..... Jan.,
Anti-Freeze for Tractor Tires ..... Feb.,
Pointers for Pumps ..... Aug.,
Better Care of Machinery ..... Sept.,
Efficient Farm Machinery ..... Dec.,
Portable Seed Cleaning ..... Jan.,
Nebraska's Tractor Tests ..... June,
Rubber Tires vs. Steel Wheels ..... Oct.,
The Most from the Motor ..... Nov.,
Mechanized Land Clearing ..... Dec.,

Fruit

Transporting Trees When in Leaf ... March,
New Chemical to Control Peach Borer, Aug.,
Fighting Fire Blight ..... Aug.,
Wound Protectants ..... Aug.,
Fertilizing for Fruit ..... May,
How to Save Girdled Apple Trees ... May,
New Method of Apple Propagation ... May,
New Uses for Fruit ..... July,
Contour Planting in Orchards ..... Sept.,
Flour from Apples ..... Sept.,
Old-Country Grapes ..... Sept.,
Wax Emulsions for Fruits ..... Oct.,
Optimum Orchard Age ..... Dec.,
Stationary Spraying Equipment ... Feb.,
No Substitute for Soil Fertility ... March,
Plant Food Development ..... March,
Blueberries ..... April,
Spray to Halt Dropping of Apples ... May,
New Practices to Regulate Fruit Crop, May,
Strawberries for the Home Garden ... May,
Blueberries in the Garden ..... June,
Diversification on the Fruit Farm ... June,
New Control for Peach Borer ..... July,
New Orchard Culture ..... Sept.,

INDEX

...rage and Transportation of Fruit..Nov., 1940
...e Tractor Operation ..... Nov., 1940
...hard Replacement ..... Dec., 1940

...ures
...on Deficiency Becomes a Problem..Jan., 1939
...p Manure Piles Wet ..... Jan., 1939
...duction of Artificial Manures..Jan., 1939
...anced Plant Nutrition ..... Feb., 1939
...tilizers for Soybeans ..... March, 1939
...ting the Most out of Nitrogen..March, 1939
...e Placement of Fertilizer ..... April, 1939
...rtilized Ponds Produce More Fish..May, 1939
...ure to Put Fertilizer ..... June, 1939
...rtilizers Boost Corn Profits ..... July, 1939
...ed Nitrogen Comes of Age ..... Aug., 1939
...ash Fertilizers ..... Sept., 1939
...w to Feed Crops ..... Sept., 1939
...e and Fertilizer ..... Oct., 1939
...rtilizing without Danger of Injury..Oct., 1939
...w Citrus Varieties ..... Nov., 1939
...or and Quality in Apples ..... Nov., 1939
...operative Grape Association..... Nov., 1939
...rtilizer's New Unity Ratios ..... Jan., 1940
...erphosphate Magic ..... Feb., 1940
...pecting Fertilizers ..... Feb., 1940
...rtiliser Practices in the South..March, 1940
...Good Way to Spread Lime ..... Oct., 1940
...sphate Magic ..... Nov., 1940

...tures for Hogs ..... Oct., 1939
... Finish in Five Months ..... Nov., 1939
...s May Harvest Sorghums ..... Dec., 1939
...ts on Hog Raising ..... Jan., 1940
...ker Pyramid ..... Feb., 1940
...ntagious Abortion in Hogs ..... Feb., 1940
... Breeders ..... March, 1940
...t Step in Swine Improvement..April, 1940
...rotic Entritis of Swine ..... May, 1940
...dling Pigs to be Butchered..... May, 1940
...-Purpose Pig Protein ..... June, 1940
...y Testing in Minnesota ..... Aug., 1940
...k by Postel ..... Sept., 1940
...Creep Feeding a Fad? ..... Sept., 1940
...y Cholera Vaccine ..... Sept., 1940
...brid Corn Best Hog Feed ..... Nov., 1940
...a Need Vitamins ..... Dec., 1940

...s
...eding Horses to Remount the Army, July, 1940
...ding Farm Horses ..... Aug., 1940
...dling Young Horses ..... Sept., 1940
... Lippizans ..... Oct., 1940
...munization for Sleeping Sickness..Oct., 1940
...ding and Management of Thoroughbreds, Oct., 1940
...rses in Modern Warfare ..... Dec., 1940
...ew Horse for America ..... Dec., 1940

...res
...ener Pastures ..... Nov., 1939
...rovation Makes Pastures Profitable, Feb., 1940
...overing Ranges ..... Feb., 1940
...erate Stocking on the Range..March, 1940
...roving Permanent Pastures..March, 1940
...ed Pasture Mix ..... March, 1940
...er Grasses for Pastures..... April, 1940
...Cattle—Good Grass ..... April, 1940
...erous Grass ..... May, 1940
...establishing Buffalo Grass ..... July, 1940
...ure Treatments Compared ..... Dec., 1940

Poultry

Sawdust for Picking Poultry ..... April, 1940
Table Poultry ..... April, 1940
Proven Poultry Sires ..... April, 1940
Squab Chickens ..... May, 1940
New Breed of Chicken ..... May, 1940
Better Poultry Ranges ..... May, 1940
Legume Silage for Poultry ..... May, 1940
Rapid Growth-Quick Feathering..June, 1940
Greenbacks from Green Pastures..June, 1940
Smoke Flavored Turkey ..... June, 1940
Grass Silage for Layers ..... June, 1940
Egg-Laying Contests ..... June, 1940
Feeding for Squab Production ..... July, 1940
Chick Disturbances ..... July, 1940
Why Poults Die in the Shell ..... July, 1940
Hybrid Chickens ..... Aug., 1940
Good Summer Management ..... Aug., 1940
Daily Chores ..... Aug., 1940
Novel Poultry House ..... Sept., 1940
Turkeys for Eggs and Meat ..... Sept., 1940
Mixing Rations for Poultry ..... Sept., 1940
Outdoor Brooding in the Rain ..... Oct., 1940
Culling Pays Dividends ..... Oct., 1940
Stone Yard System ..... Oct., 1940
A Poultry Problem ..... Oct., 1940
Moisture is Important ..... Oct., 1940
Squab Production ..... Nov., 1940
Grain for Turkeys ..... Nov., 1940
Confusion about Blood Testing ..... Nov., 1940
Ozark Fried Chicken ..... Dec., 1940
Hen House Roofs ..... Dec., 1940
Tremulous Air Cells ..... Dec., 1940
Incubator Fumigation ..... Dec., 1940
Control of Poultry Diseases ..... Dec., 1940

Sheep

Tomorrow in Sheep ..... Jan., 1940
Wintering the Flock ..... Feb., 1940
Crossbred Lambs ..... March, 1940
Pregnancy Disease of Sheep ..... March, 1940
Self-feed Lambs for Profit ..... April, 1940
Sheep Production Programs ..... July, 1940
Corriedales for Crossbreeding ..... Aug., 1940
Safe Lamb Feeding ..... Sept., 1940
Sheep Production ..... Sept., 1940
A Sheep Plan That Works ..... Oct., 1940
Wool Values ..... Oct., 1940
Hard or Mellow Backs ..... Dec., 1940
Self-fed Lambs Do Well ..... Dec., 1940

Silage

Binder to Cut Alfalfa for Silage..... Aug., 1939
Small Grain Silage ..... Sept., 1939
Stack Silage for Bundled Feed..... Oct., 1939
The New Silages ..... May, 1940
Grass Silage Steps Ahead ..... Nov., 1940

Vegetables

Delayed Spraying of Tomatoes..... May, 1939
A Starter for Tomato Plants..... June, 1939
They Did It Themselves ..... June, 1939
Chloropierin Soil Fumigation ..... July, 1939
Pruning Staked Tomatoes ..... Aug., 1939
Bacterial Wilt of the Potato..... Aug., 1939
Rain Making ..... Sept., 1939
Potato Pioneers ..... Jan., 1940
Mulching Tomatoes with Straw ..... June, 1940
Vegetable Varieties of Soybeans..... June, 1940
Fertilizing Vegetable Crops ..... July, 1940
Value in Seed Potatoes ..... Nov., 1940

COMMENTS

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